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Region 2 RAC2
Remedial Action Contract

Final Human Health Risk Assessment

Mansfield Trail Dump – OU1

Focused Feasibility Study

Byram Township, New Jersey

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471815

CDM Smith

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Acronyms

1,1-DCA	1,1-dichloroethane
ATSDR	Agency for Toxic Substances and Disease Registry
bgs	below ground surface
Cal/EPA	California Environmental Protection Agency
CDC	Centers for Disease Control and Prevention
CDM Smith	CDM Federal Programs Corporation
cis-1, 2-DCE	cis-1, 2-dichloroethene
CLP	Contract Laboratory Program
CNS	central nervous system
COPC	chemical of potential concern
CSM	conceptual site model
CTE	central tendency exposure
DESR	Data Evaluation Summary Report
EPA	U. S. Environmental Protection Agency
EPC	exposure point concentration
EES JV	Engineering & Environmental Solutions
FFS	Focused Feasibility Study
FS	Feasibility Study
ft	foot
HHRA	human health risk assessment
HI	hazard index
HQ	hazard quotient
IEUBK	Integrated Exposure Uptake Biokinetic
IRIS	Integrated Risk Information System
IUR	inhalation unit risk
LOAEL	lowest-observed-adverse-effect level
MIP	membrane interface probe
NAPL	non-aqueous phase liquid
NOAEL	no-observed-adverse-effect level
NJDEP	New Jersey Department of Environmental Protection
OEHHA	Office of Environmental Health Hazard Assessment
OSWER	Office of Solid Waste and Emergency Response
PARCC	precision, accuracy, representativeness, completeness, and comparability
PCE	tetrachloroethene
POET	point-of-entry treatment
PPRTV	Provisional Peer Reviewed Toxicity Values
QA	quality assurance
QAPP	quality assurance project plan
QC	quality control
RAC	Remedial Action Contract
RAGS	Risk Assessment Guidance for Superfund
RfC	reference concentration

RfD	reference dose
RI	Remedial Investigation
RL	reporting limit
RME	reasonable maximum exposure
ROW	right-of-way
RSL	Regional Screening Level
SF	slope factor
SVOC	semi-volatile organic compound
TAL	target analyte list
the site	Mansfield Trail Dump Site, Operable Unit 1
TCE	trichloroethene
TCL	target compound list
UCL	upper confidence limit
VC	vinyl chloride
VOC	volatile organic compound
mg/kg-day	milligram per kilogram per day
mg/m^3	milligram per cubic meter
µg/dL	microgram per deciliter
µg/L	microgram per liter
$µg/m^3$	microgram per cubic meter

Executive Summary

CDM Federal Programs Corporation (CDM Smith) received Work Assignment 069-RICO-A238 under the Remedial Action Contract (RAC) 2 (Contract No. EP-W-09-002) to prepare a focused feasibility study (FFS) for the U.S. Environmental Protection Agency (EPA), Region 2, at the Mansfield Trail Dump Site, Operable Unit 1 (the site), located in Byram Township, New Jersey. The purpose of the FFS is to investigate alternate drinking water supply sources for the impacted residences within the area of the identified groundwater plume.

As part of the FFS, this Human Health Risk Assessment (HHRA) is developed to characterize potential human health risks associated with use of impacted groundwater from the site in the absence of any additional remedial action. The HHRA is conducted in accordance with current EPA guidance outlined in *Risk Assessment Guidance for Superfund* (RAGS), Parts A, D, E, and F and other EPA guidance pertinent to human health risk assessments.

Site Location and Description

The site consists of five former waste disposal trenches located on wooded, undeveloped property in Byram Township, Sussex County, New Jersey. The site is situated along a wooded ridge trending north-south and between Stanhope-Sparta Road (County Road 605) and Brookwood Road, just beyond a closed rail overpass. High-power electrical transmission lines, surrounded by a cleared right-of-way (ROW), run through the site along the ridge. The Mansfield Bike Trail, a public pedestrian and bicycle path that originates at the Byram Township elementary school to the west of the site, passes through the eastern portion of the site.

The site consists of hilly terrain with the highest elevation along the peak of the ridge in the western area. The site is bounded to the east by a steep narrow valley associated with the New Jersey transit railroad bed and ROW with drainage ditches that flow north on both sides of the ROW on each side of the rail bed. The ditches associated with the rail bed drain into Cowboy Creek, which flows into Lubbers Run and ultimately to the Musconetcong River. A residential area is located immediately northwest and downhill from the site, with houses relying on private wells for tap water. The Byram Township elementary and secondary schools are located north of the residential area, on the far side of Cowboy Creek (EES JV 2016).

Five former waste disposal trenches (Dump Areas) make up the source area. Four of the former Dump Areas were excavated to bedrock in a removal action (Weston Solutions, Inc. [Weston], 2013). Trichloroethene (TCE) has migrated in groundwater from the former Dump Areas to nearby residential supply wells at concentrations exceeding New Jersey Drinking Water Quality Standard. Several other contaminants, including cis-1,2-dichloroethene (cis-1,2-DCE), chromium, and lead have also been detected in the impacted residential wells at concentrations exceeding the New Jersey Drinking Water Quality Standards.

Data Evaluation

From August 2013 to December 2015, EPA's contractor Engineering & Environmental Solutions (EES JV) performed remedial investigation (RI) activities at this site. The RI activities were

conducted to characterize the nature and extent of contamination and to identify possible sources of the groundwater contamination. The contractor collected environmental data, including overburden soil samples, subsurface soil samples, rock core samples, and groundwater samples. A data usability assessment of the groundwater analytical data was performed by the contractor and documented in their Data Evaluation Summary Report (DESR) (EES JV 2016). The contractor determined that the RI data (which includes groundwater data from the November 2014 monitoring well sampling event that is used in this HHRA) are usable as reported with the data validation qualifiers added except for rejected data, which were not used for project decisions.

Chemicals of potential concern (COPCs) are identified based on criteria outlined in EPA risk assessment guidance, primarily through comparison of maximum detected concentrations to risk-based screening levels. COPCs identified in groundwater are:

- twelve VOCs including 1,1,2,2-tetrachloroethane, 1,1-dichloroethane (1,1-DCA), 1,2,3-trichlorobenzene, 1,2-dichloroethane (1,2-DCA), 1,4-dichlorobenze, benzene, bromodichloromethane, chlorobenzene, chloroform, cis-1,2-DCE, TCE, and vinyl chloride (VC);
- eight semi-volatile organic compounds including 1,4-dioxane, 2,3,4,6-tertrachlorophenol, benzo(a)anthracene, benzo(b)fluoranthene, bis(2-ethylhexyl)phthalate, and naphthalene; and
- eight inorganics including antimony, chromium, cobalt, iron, lead, manganese, nickel, and thallium.

Exposure Assessment

Potential exposure pathways are defined based on potential source areas, release mechanisms, and current and potential future uses of the site. Current and future potential receptors at the site who may be exposed to groundwater are nearby residents with private wells, using groundwater as tap water at their residences. Exposure pathways evaluated for groundwater include ingestion of, and dermal contact with, groundwater and inhalation of vapor released during showering and bathing by residents.

Exposure point concentrations (EPCs) for the COPCs are used in the exposure assessment calculations to estimate potential chemical intake. The EPC is the lower of the upper confidence limit (UCL) on the mean or the maximum detected concentration.

Quantification of exposure includes evaluation of exposure parameters that describe the exposed population (e.g., contact rate, exposure frequency and duration, and body weight). Each exposure parameter in the equation has a range of values. Daily intakes are calculated based on the reasonable maximum exposure (RME) scenario (an upper bound exposure reasonably expected to occur). The intent is to estimate a conservative exposure case that is still within the range of possible exposures. Central tendency exposure (CTE) assumptions are also developed when the estimated risks under the RME scenario exceed EPA's threshold risk range. CTE scenarios reflect more typical exposures.

Toxicity Assessment

COPCs are quantitatively evaluated on the basis of their noncancer and/or cancer potential. The reference dose (RfD) and reference concentration (RfC) are the toxicity values used to evaluate noncancer health hazards in humans. Inhalation unit risk and slope factor are the toxicity values used to evaluate cancer health effects in humans. These toxicity values are obtained from various sources following the hierarchy order specified by EPA.

Risk Characterization

Risk characterization integrates the exposure and toxicity assessments into quantitative expressions of risks/health effects. To characterize potential noncancer health effects, comparisons are made between estimated intakes of substances and toxicity thresholds. Potential cancer effects are evaluated by calculating probabilities that an individual will develop cancer over a lifetime exposure based on projected intakes and chemical specific dose-response information. In general, EPA recommends an acceptable cancer risk range of 1×10^{-6} (1 in a million) to 1×10^{-4} (1 in a 10,000) and noncancer health hazard index (HI) of unity (1) as threshold values for potential human health impacts (EPA 1989). These values aid in determining whether additional remedial action is necessary at the site.

For residential use of groundwater from the core of the plume, the estimated cancer risks exceed EPA's acceptable range of 1×10^{-6} to 1×10^{-4} for both the RME and CTE scenarios (RME: 1×10^{-2}; CTE: 3×10^{-3}), primarily due to chromium, VC, and TCE in groundwater. The cancer risk may be overestimated because it was assumed that all of the chromium is in the more toxic hexavalent form, and included a maximum detected concentration that was anomalously higher than other detected concentrations. However, if chromium were assumed to be present in its trivalent form, the total risk from other carcinogens (5×10^{-3} for RME and 1×10^{-3} for CTE) still exceeds EPA's threshold of 1×10^{-4}, primarily due to VC and TCE. In addition, when the chromium outlier is replaced with the next highest concentration detected in the well, and assuming the chromium is in the hexavalent form, the total risk from all carcinogens again decreases to 5×10^{-3} for RME and 1×10^{-3} for CTE and would still exceed EPA's threshold of 1×10^{-4}.

The total noncancer HI for adult residential use of groundwater is above EPA's threshold of unity (1) under both the RME (110) and CTE (18) scenarios. Similarly, the total noncancer HI for child residential use of groundwater is above EPA's threshold of unity (1) under both the RME (106) and CTE (33) scenarios. The estimated noncancer hazards are driven primarily by potential exposure to TCE and chromium in groundwater, and to a lesser extent by nickel, cobalt, and cis-1,2-DCE. When outlier concentrations of chromium and nickel are excluded from the calculations, total HIs still exceed EPA's threshold of unity, mainly due to TCE in groundwater, and to a lesser extent cobalt and cis-1,2-DCE.

Based on the results above, the total HIs for future residents are above 1 for both the RME and CTE scenarios, and are driven primarily by potential exposure to TCE and chromium in groundwater, and to a lesser extent by nickel, cobalt, and cis-1,2-DCE. Exposure to high concentrations of TCE can impact several organ systems, and elevated HIs for the following organs/effects are primarily the result of exposure to TCE in groundwater: kidney, liver, heart, immune system, and development.

Lead was selected as a COPC in groundwater and evaluated using Integrated Exposure Uptake Biokintetic (IEUBK) Model for Lead in Children. EPA's risk reduction goal for contaminated sites is that no more than five percent of the population of children exposed to lead will have blood lead concentrations greater than 10 microgram per deciliter (µg/dL). Based on the results of the IEUBK model, lead in groundwater is below levels of concern for child residents who may ingest contaminated groundwater at the tap.

Section 1
Introduction

CDM Federal Programs Corporation (CDM Smith) received Work Assignment 069-RICO-A238 under the Remedial Action Contract (RAC) 2 (Contract No. EP-W-09-002) to prepare a Focused Feasibility Study (FFS) for the U.S. Environmental Protection Agency (EPA), Region 2, at the Mansfield Trail Dump Site, Operable Unit 1 (OU1) (the site), located in Byram Township, New Jersey. The purpose of the FFS is to investigate alternate drinking water supply sources for impacted residences within the area of the identified groundwater plume. As part of the FFS, this Human Health Risk Assessment (HHRA) is developed to characterize potential human health risks associated with residential use of impacted groundwater from the site in the absence of any remedial action. A separate HHRA will be conducted in association with a subsequent remedial investigation/ feasibility study (RI/FS) that considers additional receptors and contaminated media associated with the site.

This HHRA identifies the potential exposure pathways by which populations may be exposed to impacted groundwater. Exposure pathways are identified based on considerations of the sources and locations of contaminants related to the site, the likely environmental fate of the contaminants, and the location and activities of the potentially exposed populations. The HHRA describes exposure points and routes of exposure for each exposure pathway, as well as underlying assumptions regarding receptor characteristics and behavior (e.g., body weight, ingestion rate, and exposure frequency). The HHRA also identifies chemicals of potential concern (COPCs) for the environmental medium of concern (i.e., groundwater), exposure point concentrations (EPCs), and toxicity values of COPCs. Finally, the HHRA characterizes potential cancer risks and noncancer health hazards associated with each complete exposure pathway.

1.1 Overview

This HHRA is developed in accordance with EPA guidance documents. In addition, CDM Smith reviewed available information pertaining to the site to prepare this HHRA. Potential exposure pathways, exposure routes, and potentially exposed populations under current and future land-use scenarios are identified. Exposure parameters and daily intakes for exposure scenarios are quantified and toxicity values for COPCs are presented. The exposure pathways and receptors, exposure parameters, daily intakes, and toxicity values are presented in tabular form in accordance with the standard tables in *Risk Assessment Guidance for Superfund (RAGS) Part D* (EPA 2001) and the Office of Solid Waste and Emergency Response (OSWER) Directive 9200.1-120 (EPA 2014a).

1.2 Report Organization

This HHRA is composed of eight sections, with tables and figures presented at the end of the text. The organization of the report and the contents of each section are described below.

Section 1 Introduction – provides an overview of the objectives and organization of the HHRA.

Section 2 Site Background and Setting – briefly describes the site location and description, site history, site geology and hydrogeology, and demography and land use.

Section 3 Data Evaluation – presents sample collection and analysis of groundwater, analytical data summary, data usability, and identification of COPCs.

Section 4 Exposure Assessment – presents the conceptual site model (CSM) and identifies potential exposure pathways and potential receptor populations under both current and future land-use scenarios. In addition, methods for calculating EPCs and exposure parameter assumptions are presented.

Section 5 Toxicity Assessment – discusses the relevant toxicity information of identified COPCs.

Section 6 Risk Characterization – integrates the toxicity and exposure assessments into quantitative and qualitative expressions of risk and discusses uncertainties associated with the risk estimates.

Section 7 Summary and Conclusions – summarizes the results of the risk assessment and presents conclusions based on the results.

Section 8 References – lists references cited in this report.

Section 2
Site Background and Setting

This section discusses the site location and description, site history, site geology and hydrogeology, and demography and land use. This information is used to develop site-specific information on exposure pathways and receptors associated with the site.

2.1 Site Location and Description

The site consists of five former waste disposal trenches located on wooded, undeveloped property in Byram Township, Sussex County, New Jersey (Figure 2-1). The site is situated along a wooded ridge trending north-south between Stanhope-Sparta Road (County Road 605) and Brookwood Road, just beyond a closed rail overpass. High-power electrical transmission lines, surrounded by a cleared right-of-way (ROW), run through the site along the ridge. The Mansfield Bike Trail, a public pedestrian and bicycle path that originates at the Byram Township elementary school to the west of the site, passes through the eastern portion of the site.

The site consists of hilly terrain with the highest elevation along the peak of the ridge in the western area. The site is bounded to the east by a steep narrow valley associated with the New Jersey transit railroad bed and ROW with drainage ditches that flow north on both sides of the ROW on each side of the rail bed. The ditches associated with the rail bed drain into Cowboy Creek, which flows into Lubbers Run and ultimately to the Musconetcong River. A residential area is located immediately northwest and downhill from the site. The Byram Township elementary and secondary schools are located north of the residential area, on the far side of Cowboy Creek (EES JV 2016).

Five former waste disposal trenches make up the source area (Figure 2-2) and are designated as former Dump Areas A, B, C, D, and E. Dump Areas A, B, D, and E were excavated to bedrock in a removal action (Weston Solutions, Inc. [Weston] 2013). Dump Areas A, B, and D consisted of one or more trenches where waste material of unknown origin (resembling sludge) was deposited. Dump Area C consisted of a disturbed area adjacent to Dump Area B. Dump Area E consisted of four parallel mounds in a wooded area between Dump Areas B and D. The Mansfield Bike Trail described above runs north-south along the east side of Dump Areas D, and E (EES JV 2016).

Trichloroethene (TCE) has migrated in groundwater from the former Dump Areas to nearby residential supply wells at concentrations exceeding New Jersey Drinking Water Quality Standards. Several other contaminants, including cis-1,2-dichloroethene (cis-1,2-DCE), chromium, and lead have also been detected in the impacted residential wells at concentrations exceeding the New Jersey Drinking Water Quality Standards.

2.2 Site History

The Sussex County Department of Health and Human Services and the New Jersey Department of Environmental Protection (NJDEP) first became aware of contamination in May 2005 when TCE concentrations were identified above New Jersey Drinking Water Standards in residential wells

serving homes on Brookwood Road and Ross Road (Figure 2-2). NJDEP sampled the residential wells in these neighborhoods in 2006 and results indicated TCE concentrations ranged from 3.9 to 70 micrograms per liter (µg/L). Point-of-entry treatment (POET) systems were installed by NJDEP in 17 homes to remove the groundwater contamination prior to use as drinking water.

In March 2011, the Mansfield Trail Dump site was added to the National Priorities List, based on the affected on-site and residential areas and the Hazard Ranking System results.

From August 2013 to December 2015, EPA's contractor Engineering & Environmental Solutions (EES JV) performed RI activities at this site. The contractor collected environmental data, including overburden soil samples, subsurface soil samples, rock core samples, and groundwater samples, and performed site reconnaissance activities. The contractor also collected water samples from 16 of the 17 targeted residential wells that were equipped with POET system and an additional 8 residential wells without POET systems. These results are described in the Revised Data Evaluation Summary Report (DESR) for the Mansfield Trail Dump Site (EES JV 2016).

2.3 Site Geology and Hydrogeology

This section provides a brief summary of the lithologic and hydrogeologic characteristics of the site and immediate area. A more detailed description of site geology and hydrogeology can be found in the Revised DESR (EES JV 2016).

Regional Setting

The site is located in a physiographic province known as the Highlands. The Highlands include rugged terrain and mountainous uplands consisting of erosion resistant rocks in northeast trending ridges. The rocks of the Highlands are over one billion years old and once were part of ancient mountain belts (i.e., Appalachian Mountains) formed from colliding tectonic plates.

The site is located within the United States Geological Survey Stanhope quadrangle. The Stanhope quadrangle is underlain by a variety of Precambrian gneisses and Middle Proterozoic foliated granitoid bedrock. Gneiss is a foliated metamorphic rock consisting of mineral grains with a banded appearance of alternating light- and dark-colored layers. It typically contains abundant quartz or feldspar minerals. The aerially most abundant rocks on the quadrangle are clinopyroxene-bearing syenites and granites, which intruded into the layered gneisses during the Grenville Orogeny (Volkert *et al*. 1989).

Overburden

The overburden is relatively thin (less than 5 feet thick) along the top and flanks of the ridge where the former dump areas are located. Overburden thickness generally increases in the flat areas to the southeast of the ridge. The thickest overburden in the former dump areas is located in the southern portion of Dump E, where the overburden is up to 25 feet thick. Water levels in the thicker parts of the overburden were 5-10 feet (ft) below ground surface (bgs). The overburden thins to the southeast of Dump C; this trend appears to continue within the depression southwest of Dump C, but drill rigs could not access this area because of standing water during the RI.

In the residential area northeast of the site, the overburden thickness increases from just several feet at the toe of the bedrock cliffs to almost 50 feet north of Brookwood Road as the bedrock drops away from the ridge. In some areas, a layer of saprolite (weathered bedrock) was encountered above the bedrock. In these areas, groundwater is shallow (less than 10 feet bgs) and likely discharges to Cowboy Creek.

Bedrock

Site area bedrock consists of Proterozoic gneiss (Losee Gneiss) and pyroxene syenite. The Losee Gneiss is described as medium-fine to medium-coarse grained and weakly foliated, with foliations trending southwest to northeast. The gneiss and pyroxene syenite are part of the Hopatcong Intrusive Suite (Volkert, et al. 1989). The bedrock surface generally mirrors the topography at the site, and is exposed in numerous locations along the ridge the former dump areas occupy.

The fractured bedrock aquifer is the drinking water source for the residential area north of the former dump areas. Private residential wells were constructed as open-hole bedrock wells with surface casings to 50 feet bgs and total depths ranging from 100 to 300 feet bgs. Groundwater flow in the bedrock is generally toward the northwest but is restricted to connected water-bearing fractures and is influenced by a complex system of fractures, joints, local and regional faults, and localized pumping of private wells.

Previous studies found that water-bearing bedrock fractures tend to be found in broad zones. Fracture density data suggested that the upper 50 feet of bedrock in the source area is generally more fractured. For this reason, the upper 50 feet of bedrock was identified as a separate hydrogeologic unit. The deeper bedrock was then split into two units, intermediate and deep. The dividing point for the intermediate and deep bedrock was identified as 200 feet below the top of rock, which is below the pump and many of the bottom of the wells screens for the residential wells.

2.4 Demography and Land Use

The northern portion of the site and the residential area to the north are located in Byram Township, while the southern portion of the site is located in the Borough of Stanhope. Byram Township is a small rural town located just south of Lake Mohawk in northern New Jersey. Byram Township is comprised of 22.3 square miles with a population of 8,350 and a population density of 396 people per square mile (U.S. Census 2010).

The site is located south of and adjacent to a populated neighborhood. The area surrounding the site is predominantly developed with housing units, local government facilities, and commercial properties. The site is zoned as a residential district (R-1) in Byram Township, and the residential area to the north is also zoned as residential (R-3 and R-4). There does not appear to be any future plan for further growth in the immediate area (EES JV 2016).

The primary receptors for groundwater impacted by the site are the residents to the north of the former disposal areas.

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Section 3
Data Evaluation

Samples of groundwater were collected in order to characterize the nature and extent of contamination at the site. The data evaluation step consists of reviewing and evaluating available groundwater data which allows for the identification of COPCs. The following subsections describe sample collection and analysis, data usability and the suitability of data for risk assessment purposes, analytical data summary, and the approach used to identify COPCs.

3.1 Sample Collection and Analysis

On behalf of EPA, EES JV conducted field investigations at the site to characterize the nature and extent of contamination at the site. Samples collected during the RI and used in the HHRA are presented in Appendix A. The HHRA uses existing monitoring well data from the core of the plume to identify potential risks associated with impacted groundwater. Residential well data are not being considered for use in the HHRA. EPA does not recommend including residential well data because reliable information is limited about the construction and depth of the residential wells, and the data may not reflect reasonable maximum exposure conditions (EPA 2014b).

Groundwater samples considered for use in this HHRA were collected from site monitoring wells during the RI conducted by EES JV. Samples collected in 2014 and 2015 were analyzed for target compound list (TCL) volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), SVOC-selected ion monitoring, pesticides, Aroclors, and target analyte list (TAL) inorganics. In addition, limited sampling was conducted in 2016 of two monitoring wells, MW-7 and MW-8, with samples analyzed for inorganics and 1,4-dioxane.

The monitoring wells available for consideration in the HHRA include:

- MW-1, MW-2, and MW-3 - open-hole bedrock monitoring wells sampled at three discreet depth intervals
- MW-4 through MW-8 and MW-12 through 14 - overburden monitoring wells screened across the water table to evaluate the shallow overburden groundwater and potential vapor intrusion impacts
- MW-9 through MW-11- screened either at the top of competent rock or within water-bearing units within the saprolite that were close to competent rock
- MLS-1 through MLS-9 and MLS-11 – multi-level system wells with up to five, six, or seven sampling ports located in shallow, intermediate, and deep bedrock aquifers

The monitoring well locations are provided on Figure 3-1.

Prior to screening for the identification of COPCs, the monitoring well data were evaluated in accordance with *Determining Groundwater Exposure Point Concentrations, Supplemental Guidance* (EPA 2014b). This guidance outlines a recommended approach for estimating a groundwater EPC

for use in evaluating risk posed by reasonable maximum exposure (RME) conditions at sites with contaminated groundwater. Applying this guidance to the available monitoring wells identified above produces a set of monitoring wells that are located in the core of the plume (distinguished by higher concentration levels compared to the lower levels at the plume fringe) and whose data are used for screening for the identification of COPCs and EPC estimations. Information considered in the monitoring well selection process included:

- Available sample data – as noted above, all the monitoring well data collected in 2014, 2015, and 2016 are considered in the selection process.
- Aquifer evaluation to determine if the overburden and bedrock aquifers should be evaluated as a group or separately.

  Overburden Aquifer
  Since the overburden is discontinuous across the site and detections of representative contaminants of concern in the overburden monitoring wells MW-4 through MW-14 are low (TCE detections ranging from non-detect to 17 µg/L; cis-1,2-DCE detections ranging from non-detect to 8.7 µg/L; vinyl chloride (VC) detected once at 0.28 J µg/L; and tetrachloroethene (PCE) not detected in any of the overburden wells) when compared to detections of the same contaminants in the bedrock aquifer, separate EPCs are not being developed specific to the overburden aquifer.

  Bedrock Aquifer
  The fractured bedrock aquifer is the drinking water source for the residential area north of the site. Although the bedrock aquifer is divided into three distinct hydrogeologic zones (shallow, intermediate, and deep), screening for the identification of COPCs and EPC estimations is based on monitoring well data from the bedrock treated as a whole unit, without specific focus on the distinctions between hydrogeologic units within the aquifer.
- Monitoring well construction details – see above.
- CSM – see Section 4.1.1 for a description of the CSM.
- Monitoring well location – EPA recommends using data from at least three wells located in the core of the plume. Based on Figures 5-3 through 5-4c in the DESR (EES JV 2016) which show the aerial extent and cross-sections of the TCE plume, the main groundwater contaminant at the site, several monitoring wells are located in the core of the TCE plume. However, other contaminants detected in the groundwater at the site were also considered when selecting the set of monitoring wells to be used for screening to identify COPCs and for the EPC estimations.
- Monitoring wells with multiple depth samples – EPA recommends using the highest detected concentration from samples from such monitoring wells to calculate the EPC. This recommendation is followed for the monitoring wells located in the bedrock aquifer that have multiple sampling depth results.

Taking the above information into consideration, ten bedrock monitoring wells located in the core of the TCE plume are selected for use in the HHRA. These ten wells include MW-1, MW-2, and

MLS-2 through MLS-9 (see Figure 3-1). Only the November 2014 groundwater results associated with these ten wells are used in screening to identify the COPCs and in EPC estimations. The November 2014 groundwater sample results are selected because more wells were sampled during this sampling round than in any other sampling event. In addition, the highest values of some representative contaminants affecting the residential groundwater supply downgradient of the site (TCE, cis-1,2-DCE, and VC) are similar to concentrations detected in other rounds of sampling. The highest detected concentration from multiple depth samples from the ten monitoring wells is used to identify COPCs and in the EPC estimations. Samples used in this HHRA are listed in Table A-1 in Appendix A.

3.2 Data Usability

The data used in the HHRA were generated during the RI conducted by EES JV at the site from August 2013 to December 2015 and documented in their Revised DESR (2016). The fieldwork was conducted in accordance with the Quality Assurance Project Plans (QAPPs) (EES JV 2013 and 2015). EPA Region 2 performed data validation on the Contract Laboratory Program (CLP) generated groundwater data.

EES JV performed a data usability evaluation of the data. EES JV documented in the Revised DESR (2016) that the analytical results were evaluated in accordance with precision, accuracy, representativeness, completeness, and comparability (PARCC) parameters to verify the attainment of project quality objectives. Of these PARCC parameters, precision and accuracy were evaluated quantitatively through the collection of the quality control (QC) samples. Minor discrepancies were identified. The percent completeness value was calculated by dividing the number of usable sample results by the total number of sample results planned for this investigation. The completeness was calculated to be 99.3 percent for the data collected (including groundwater). The overall analytical performance for these data were deemed acceptable. The quality assurance (QA)/QC data verification and validation of analytical results satisfied the data quality objectives established in the site-specific QAPPs (EES JV 2013 and 2015). Project-level data validation to evaluate field duplicate and field blank data for overall sample result precision and accuracy, and to reconcile multiple results for a single parameter due to dilutions or re-extractions, was also performed. EES JV's review of EPA Region 2's validation of CLP-generated laboratory data found no major discrepancies and considered EPA Region 2's qualifications final with additional qualifiers inserted by EES JV during project level validation.

The following qualifiers were determined by the data validation and used in the presentation of analytical results:

- U (non-detect): The analyte was not detected above either the sample quantitation limit or sample detection limit.
- J (estimated): The analyte was detected below the reporting limit (RL) or the direction of analytical bias was unknown.
- UJ (estimated non-detect): The analyte was not detected and validation suggested a bias (of unknown direction) in the analytical results.
- R (rejected): Data are not of acceptable quality to be used.

The contractor determined that the RI data (which includes groundwater data from the November 2014 monitoring well sampling event) are usable as reported with the data validation qualifiers added, except for rejected data, which are not used for project decisions.

3.3 Summary of Analytical Results

The evaluation and summary of analytical results are based on those chemicals that were reported at concentrations higher than the reporting limit in one or more samples. Statistical summaries, comprising the minimum and maximum detected concentrations and detection frequency for chemicals, are presented in Table B-2.1a in Appendix B. Select analytical data results are summarized below.

Thirty-one VOCs, 12 SVOCs, and 20 metals were detected in the monitoring well samples (Table B-2.1a in Appendix B). Contaminants of interest include the representative contaminants of concern identified in the Revised DESR (EES JV 2016), which include TCE and cis-1,2-DCE, as well as 1,1-dichloroethane (1,1-DCA), 1,4-dioxane, chromium, iron, manganese, and nickel, all of which were detected in at least 9 out of the 10 monitoring well samples. TCE was detected at concentrations ranging from 3.8 µg/L to a maximum concentration of 270 µg/L in MLS-3. Cis-1,2-DCE was detected at concentrations ranging from 1.7 µg/L to a maximum concentration of 90 µg/L in MLS-6. Iron, manganese, and 1,1-DCA were detected at concentrations ranging from 173 µg/L to 30,100 µg/L, 54.2 µg/L to 4,370 µg/L, and 0.14 J µg/L to 35 µg/L, respectively, with maximum concentrations detected in MW-1. Chromium, nickel and 1,4-dioxane were detected at concentrations ranging from 0.48 J µg/L to 622 µg/L, 1.1 µg/L to 1,260 µg/L, and 0.15 J µg/L to 26 µg/L, respectively, with maximum concentrations detected in MLS-3. These four wells (MW-1, MSL-3, MSL-5, and MLS-6) are located directly in the former Dump Area.

The other contaminants of interest detected less frequently include:

- 1,2-DCA, 1,4-diclorobenzene, benzene, and chlorobenzene (maximum detected concentrations of 0.34 J µg/L, 13 µg/L, 1.6 µg/L, and 70 µg/L, respectively) in MW-1
- 1,2,3-trichlorobenzene, bromodichloromethane, and chloroform (maximum detected concentration of 24 JN µg/L, 0.71 µg/L, and 7.4 µg/L, respectively) in MLS-2
- cobalt with a maximum detected concentration of 19.5 µg/L in MLS-3
- bis(2-ethylhexyl)phthalate and antimony (the maximum detected concentrations of 12 µg/L and 5.2 µg/L, respectively) in MLS-4
- 2,3,4,6-tetrachlorophenol and naphthalene (maximum detected concentration of 110 JN µg/L and 0.26 µg/L, respectively) in MLS-5
- VC and benzo(b)fluoranthene (maximum detected concentrations of 50 µg/L and 0.15 µg/L, respectively) in MLS-6
- 1,1,2,2-tetrachloroethane, benzo(a)anthracene, lead, and thallium (maximum detected concentrations of 0.24 J µg/L, 0.035 J µg/L, 22.8 µg/L, and 0.063 J µg/L, respectively) in MLS-7

3.4 Identification of Chemicals of Potential Concern

Screening of analytical data is conducted to identify COPCs to be further evaluated in the risk assessment. Screening helps to focus the assessment on chemicals that could pose a human health risk.

Maximum detected concentrations are compared to screening levels to identify COPCs. Chemicals are considered COPCs if the maximum detected concentration exceeds the respective screening level. The risk-based screening levels used in this risk assessment are tap water Regional Screening Levels (RSLs) for Chemical Contaminants at Superfund Sites (EPA 2016a). To account for exposure to multiple chemicals, RSLs for chemicals based on noncancer health effects are decreased by a factor of 10 to account for a target hazard quotient (HQ) of 0.1.

Group A carcinogens (i.e., known human carcinogens) are retained as COPCs even when they are present at the site at concentrations below their respective screening levels. Since the data set consisted of only 10 samples, detection frequency was not considered in eliminating COPCs.

Chemicals that are essential nutrients (magnesium, calcium, potassium, and sodium) are not considered further in the quantitative risk assessment because they are present at low concentrations. These chemicals are only toxic at very high doses.

RSLs are not available for some chemicals. Based on similarities in chemical structure and physiological activities, surrogates were used in the screening and are listed below.

- acenaphthene for acenaphthylene
- pyrene for phenanthrene

There are no RSLs nor surrogate chemicals for methylcyclohexane and 1,3-dichlorobenzene. These chemicals are qualitatively evaluated in Section 6.3.

The decision process for identifying COPCs is provided in Table B-2.1a in Appendix B. COPCs identified in groundwater for further quantitative evaluation in the HHRA are presented in Table 3-2. In addition, a supplemental screening was performed on all samples collected and listed in Appendix A, and not just the ten samples identified in Section 3.1. The purpose of this supplemental screening is to determine whether there is any impact to COPC identification and overall risk results based on the ten monitoring wells. Results of the screening are provided in Table B-2.1b in Appendix B and discussed in Section 6.3.

Risks from exposure to lead are not quantified following the exposure models for other COPCs. EPA considers lead to be a special case due to lack of toxicity values for lead. Health risks from lead are evaluated based on blood lead concentration, which can be modeled using the Integrated Exposure Uptake Biokinetic (IEUBK) Model for residential exposure scenarios. For groundwater, the screening level of 15 µg/L is based on the Federal Action Level. The screening process for lead is performed separately in the Lead Worksheet detailed in Table 3-1. As shown in Table 3-1, the maximum concentration of lead in groundwater at the site (22.8 µg/L in MLS-7) is above the screening level. Therefore, lead is identified as a COPC for the site groundwater and is evaluated using the IEUBK model (Appendix E).

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Section 4
Exposure Assessment

As a component of the HHRA, the exposure assessment strives to predict human exposure to COPCs in contaminated media at the site and in the vicinity. The exposure assessment describes exposure scenarios in which people may come into contact with COPCs, and provides equations and parameters to quantify exposure. Results of the exposure assessment are integrated with chemical-specific toxicity information to characterize potential risks.

4.1 Exposure Pathways

Potential exposure pathways for the site are defined based on current and potential future land uses. Each potential pathway is evaluated considering site-specific conditions to determine if the pathway could be present. The area demography and land use characteristics are taken into consideration when the pathways are developed. If a pathway between the source of contamination and a human receptor could potentially be complete, it is retained for further evaluation.

4.1.1 Conceptual Site Model

The primary source of the contaminants appears to be the waste materials disposed in the former Dump Areas A, B, C, D, and E. Different materials appear to have been disposed of in different dumps; therefore, separate suites of contaminants are possible within each former dump area. The removal actions in 2012 addressed most of the primary material at the dumps by excavating and removing the material down to the bedrock surface. However, free product that entered the fractured bedrock near former Dump Area A and Dump Area D remains and a "halo" of contamination that has infiltrated bedrock and/or underlying fractures may act as an ongoing source of groundwater contamination. Matrix diffusion analysis has shown that the bedrock in the vicinity of both dump areas does not appear to contain a significant mass of contaminants that could act as an ongoing source. The soil gas survey, X-ray fluorescence survey, membrane interface probe (MIP) survey, and groundwater samples collected from overburden monitoring wells during the RI indicate that overburden soils at the source area are not a significant source of contamination except in several small, very localized areas (EES JV 2016).

Dissolved phase contaminants enter groundwater and are transported by anisotropic flow through the bedrock. Groundwater flow through bedrock is expected to be dominated by secondary porosity features (fractures), where advective flow velocities are expected to be several orders of magnitude higher than advective flow through the rock's primary porosity. Groundwater is pumped into residences through privately-owned residential wells. Shallow contaminated groundwater in bedrock appears to migrate laterally into overburden north and northwest of the source area as the bedrock surface drops off along Brookwood Road. Non-aqueous Phase liquid (NAPL) may also migrate through the fractured bedrock (EES JV 2016). Groundwater from the bedrock aquifer is used as tap water by the residents with potential exposures via ingestion, showering, and bathing.

4.1.2 Identification of Exposure Pathways

As defined in the RAGS Part A (EPA 1989), an exposure pathway is composed of the following elements:

- A source and mechanism of chemical release to the environment
- An environmental transport medium (e.g., groundwater) for the released chemical and/or mechanism to transfer the chemical from one medium to another
- A point of potential contact by humans with the contaminated medium
- A route of exposure (i.e., ingestion, inhalation, or dermal contact)

In the risk assessment, pathways are identified for the No Action alternative to evaluate risk if no site remediation occurs. This assessment assumes that no additional restrictions to site access or use exist. The goal of this evaluation is to establish whether it is feasible for individuals to engage in activities resulting in exposure to contaminants.

Previous investigations at the site revealed that the groundwater sampled from residential wells located on properties on Brookwood and Ross Roads, north of the site, had TCE contamination that exceeded the New Jersey drinking water standards. The RI confirmed that groundwater at the site is contaminated with VOCs (including TCE), SVOCs, and several inorganics in site monitoring wells. POET systems were installed in 18 homes to remove the contamination in residential wells. However, if additional residential wells become contaminated or the POET systems are not maintained, residents could be exposed to contaminated groundwater via ingestion of groundwater, dermal contact with groundwater, and inhalation of chemical vapors while showering/bathing.

4.2 Characterization of Potentially Exposed Populations

Based on current and future land uses, residents near the site may be exposed to contaminated groundwater. The following subsection details the potential exposure pathways identified for residents. A summary of these exposure pathways is illustrated in Figure 4-1 and presented in Table 4-1.

4.2.1 Current and Future Receptors

Current and future receptors who may be exposed to groundwater are nearby residents with private wells, using untreated groundwater as tap water at their residences.

Residents using untreated groundwater may come into contact with contaminants through ingestion of, and dermal contact with, groundwater and inhalation of VOCs in groundwater while bathing or showering. Current and future residents (adults and children [birth to <6 years old]) are evaluated using default parameters recommended by EPA as described in Section 4.4.

4.3 Calculation of Exposure Point Concentrations

This section presents the methodology that was employed to calculate the EPCs for the groundwater COPCs.

4.3.1 Exposure Point Concentrations of Samples Collected

For each single chemical in groundwater with at least 5 samples with 4 detected values, a 95 percent (or higher) upper confidence limit (UCL) on the arithmetic mean concentration is calculated and compared to the maximum detected concentration for that chemical. The lower value of the UCL and the maximum detected value is selected as the EPC, as recommended by EPA (1992). UCLs are not calculated for data sets with less than five samples and fewer than four detected concentrations. In such cases, maximum concentrations are used as the EPCs.

Several statistical methods can be used to estimate the UCL of a data set, depending upon the data distribution. Therefore, two key steps are required to estimate the UCL of a data set.

- Determine the distribution of the data (i.e., normal, lognormal, gamma, or neither)
- Compute the UCL using the appropriate procedure for the data distribution

In this assessment, both steps were performed with the ProUCL statistical software, version 5.1.02 (EPA 2015). The ProUCL program tests the normal, lognormal, gamma, and non-parametric distributions of each data set and the UCLs are calculated with the statistical procedures recommended by EPA, based on the findings of Singh, Singh, and Engelhardt (1997, 1999) (EPA 2015). ProUCL computes the UCL using 5 parametric and 10 non-parametric methods, depending on the distribution.

- For normal distributions, the Student's t-statistic is used to calculate the UCL.
- For lognormal distributions, one of four different computation methods is used to calculate the UCL depending on the skewness of the data (as indicated by the standard deviation of the log-transformed data) and the sample size.
- For gamma distributions, one of two computation methods is used to calculate the UCL based on a "k value," which is the shape parameter of a gamma distribution. For values of $k \geq 0.1$, the exposure point concentration term is computed using an adjusted gamma UCL of the mean (when $0.1 \leq k \leq 0.5$) or an approximate gamma UCL of the mean (when $k > 0.5$). For values of $k < 0.1$, a UCL is obtained using either the bootstrap-t method or Hall's bootstrap method when the sample size is small (less than 15), or the approximate gamma for larger datasets.
- For data sets that do not fit a normal, lognormal, or gamma distribution, the ProUCL program calculates and recommends a UCL from 1 of the 10 non-parametric methods (EPA 2015).

Table B-3 in Appendix B presents the EPCs for each COPC in groundwater. As noted previously, the EPC is the lower value of the UCL and the maximum detected value. ProUCL outputs for COPCs are presented in Appendix C.

4.3.2 Indoor Air Exposure Point Concentrations Using the Shower Model

Modeling is required to estimate the indoor air concentrations of VOCs from groundwater while showering. In this scenario, receptors are assumed to inhale VOCs while showering and during

time spent in the bathroom after showering. Dermal absorption of volatilized VOCs is assumed to be negligible due to low dermal permeabilities. Methodologies for estimating exposure to VOCs in domestic water supplies from the inhalation exposure route are based on a shower model developed by Schaum *et al.* (1994).

The shower model treats the bathroom as one compartment and yields an air concentration averaged over the time of the actual shower and the time spent in the bathroom after the shower. The model was derived by assuming that the chemical contaminant volatilizes at a constant rate, instantly mixes uniformly with the bathroom air, and that ventilation with clean air does not occur. This implies that the chemical concentration in the air increases linearly from zero to a maximum level at the end of the shower, and then remains constant during the time an individual spends in the bathroom immediately after showering.

The air concentration is estimated using the water concentration. The water concentration is a site-specific value that refers to the concentration of a chemical in water as it enters the shower. The UCL value or the maximum detected value is utilized as the water concentration (i.e., the EPC listed in Table B-3 in Appendix B). Chemical-specific fraction volatilized values are calculated from these chemical properties using the equation and values provided by Schaum *et al.* (1994) and EPA's standard default parameters (EPA 2004) (see Tables D-1 and D-2 in Appendix D). Exposure point air concentrations from the shower model are presented in Tables D-3 and D-4 in Appendix D.

4.4 Exposure Parameter Assumptions

Exposure parameters for each scenario are primarily taken from EPA documents (EPA 1989, 2004, 2011a, and 2014a) and are consistent with EPA Region 2's approach. EPA's standard default assumptions (EPA 2014a) are used. Otherwise values from the most recent guidance available are used unless EPA Region 2 has a known preference for a specific value. RME and central tendency exposure (CTE) equations and parameters used in the risk assessment are provided in Tables B-4.1a and B-4.1b in Appendix B. Chemical-specific dermal permeability coefficients for COPCs are presented in Table B-4.2.

Residents are assumed to be exposed to contaminants in groundwater. Standard default exposure assumptions are used for both RME and CTE scenarios for ingestion of, and dermal contact with, groundwater and inhalation of VOCs in groundwater while bathing or showering (Tables B-4.1a and B-4.1b).

Carcinogenic exposure estimates throughout a lifetime are impacted by age-dependent intake factors. To take into account the difference in daily ingestion rates, body weights, and exposure durations for young children and adults, age-adjusted intake factors are used for carcinogenic exposure estimates (EPA 2014a). This is accomplished by using factors for a child for the first 6 years of exposure and adult factors for the remaining 20 years of the exposure period.

4.5 Method for Evaluating Exposure to Lead

Exposures to lead are not evaluated using the same methods as those described for other site-related COPCs. EPA has not published conventional quantitative toxicity values for lead because available data suggest a very low or possibly no threshold for adverse effects, even at exposure

levels that might be considered background. However, the toxicokinetics of lead are well understood and indicate that lead is regulated based on the blood lead concentration. Blood lead concentration can be correlated with both exposure and adverse health effects. In lieu of evaluating risk using typical intake calculations and toxicity criteria, EPA developed models specifically to evaluate lead exposures. For this HHRA, blood lead concentrations are estimated using the IEUBK Model for Lead in Children (IEUBK win v1.1, February 2010).

The IEUBK model is generally used to evaluate exposures to lead for young children in a residential situation. Young children are the subpopulation of primary concern for lead exposure because they tend to: (1) have higher exposures to lead in soil, dust, and paint, (2) absorb more of the lead that is ingested, and (3) are more sensitive to the toxic effects of lead than are older children or adults. Thus, protection of young children will also be protective of adults in the same environment.

The IEUBK model is a software package which allows the user to estimate, for a hypothetical child or population of children, a plausible distribution of blood lead concentrations centered on the geometric mean blood lead concentration predicted by the model from available information about children's exposure to lead. Protection of young children is considered achieved if the odds of a typical or hypothetical child (or group of similarly exposed children) with blood lead levels of 10 microgram per deciliter (µg/dL) or greater is no more than 5 percent (EPA 1994).

Exposure to lead in groundwater is evaluated for current and future child residential receptors because lead was identified as a COPC (Table 3-1). IEUBK model default parameters are used in this analysis with the exception of a lead concentration in drinking water (arithmetic mean of 10.2 µg/L is used – see ProUCL output for lead in Appendix C). Default parameters are presented in Appendix E.

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Section 5
Toxicity Assessment

Health criteria used in this risk assessment were obtained from a variety of toxicological sources according to a hierarchy established in OSWER directive 9285.7-53 (EPA 2003). The toxicity value hierarchy is as follows:

- Tier 1—EPA's Integrated Risk Information System (IRIS).
- Tier 2—EPA's Provisional Peer Reviewed Toxicity Values (PPRTVs): The Office of Research and Development/National Center for Environmental Assessment / Superfund Health Risk Technical Support Center develops PPRTVs on a chemical-specific basis when requested by EPA's Superfund program.
- Tier 3—Other Toxicity Values: Tier 3 includes additional EPA and non-EPA sources of toxicity information, such as the California Environmental Protection Agency (Cal/EPA) and the Agency for Toxic Substances and Disease Registry (ATSDR). Priority should be given to those sources of information that are the most current, the basis for which is transparent and publicly available, and which have been peer-reviewed.

5.1 Health Effects Criteria for Noncarcinogens

For chemicals that exhibit noncancer (e.g., systemic) effects, many authorities consider organisms to have repair and detoxification capabilities that must be exceeded by some critical concentration (threshold) before the health effect is manifested. This threshold view holds that a range of exposures from just above zero to some finite value can be tolerated by the organism without an appreciable risk of adverse effects.

Health criteria for chemicals exhibiting noncancer effects for use in risk assessments are generally EPA-derived reference doses (RfDs) and reference concentrations (RfCs). The RfD or RfC is an estimate of average daily exposure to an individual (including sensitive individuals) that is likely to be without appreciable risk of deleterious effects during a lifetime. The RfD is expressed in units of milligram of chemical per kilogram of body weight per day (mg/kg-day), while the RfC is expressed in units of mg chemical per cubic meter of air (mg/m^3).

RfDs and RfCs are usually derived either from human studies involving work-place exposures or from animal studies, and are adjusted using uncertainty factors to ensure that they are unlikely to underestimate the potential for adverse noncancer effects to occur. The uncertainty factors reflect scientific judgment regarding the various types of data used to estimate the RfD/RfC and range between 1 and 10. For example, a factor of 10 may be introduced to account for possible differences in response between humans and animals in prolonged exposure studies. Other factors of 10 may be used to account for variation in susceptibility among individuals in the human population, use of data from a study with less-than-lifetime exposure, and/or use of data from a study that did not identify a no-observed-adverse-effect level (NOAEL).

RfDs and RfCs provide benchmarks against which estimated doses (i.e., those projected from human exposures to various environmental conditions) might be compared. Doses that are significantly higher than the RfD/RfC may indicate an increased potential of hazard from the exposure, while doses that are less than the RfD/RfC are not likely to be associated with adverse health effects. Note that an exceedance of a reference dose or concentration does not predict a specific disease.

5.2 Health Effects Criteria for Carcinogens

For chemicals that exhibit cancer effects, EPA and other scientific authorities recognize that one or more molecular events can evoke changes in a single cell or a small number of cells that can lead to malignancy. This non-threshold theory of carcinogenesis purports that any level of exposure to a carcinogen can result in some finite possibility of causing cancer. Generally, regulatory agencies assume the non-threshold hypothesis for carcinogens in the absence of information concerning the mechanisms of cancer action for the chemical. The slope factor (SF) [in units of $(mg/kg\ body\ weight\text{-}day)^{-1}$] is a number which, when multiplied by the lifetime average daily dose of a potential carcinogen (in mg/kg body weight-day), yields the upper-bound lifetime excess cancer risk associated with exposure at that dose. The SF is developed for exposure through the oral route.

When the units are risk per microgram per cubic meter ($\mu g/m^3$), it is called the inhalation unit risk (IUR). The IUR is the upper-bound excess lifetime cancer risk estimated to result from continuous exposure to a chemical at a concentration of 1 $\mu g/m^3$ in air. Upper-bound is a term used by EPA to reflect the conservative nature of the SFs and IURs—risks estimated using SFs and IURs are considered unlikely to underestimate actual risks and may overestimate risks for a given exposure. Excess lifetime cancer risks are generally expressed in scientific notation and are probabilities. An excess lifetime cancer risk of 1×10^{-6} (one in one million), for example, represents the incremental probability that an individual will develop cancer as a result of exposure to a carcinogen over a 70-year lifetime under specified exposure conditions.

In practice, SFs and IURs estimates are derived from the results of human epidemiology studies or chronic animal bioassays. The animal studies are conducted for a range of doses, including a high dose, in order to detect possible adverse effects. Since humans are expected to be exposed at lower doses than those used in animal studies, the data are adjusted via mathematical models. The data from animal studies are typically fitted to the linearized multistage model to obtain a dose-response curve. EPA evaluates a range of possible models based on the available data before conducting the extrapolation. The most appropriate model to reflect the data is selected based on an analysis of the data set.

The 95% UCL slope of the dose-response curve, subject to various adjustments and an inter-species scaling factor, is applied to derive the health protective SF and IUR estimate for humans. Dose-response data from human epidemiological studies are fitted to dose-time-response curves. These models provide rough, but reasonable, estimates of the upper limits on lifetime risk. SF and IUR estimates based on human epidemiological data are also derived using health protective assumptions and, as such, they too are considered unlikely to underestimate risks.

Therefore, while the actual risks associated with exposures to potential carcinogens are unlikely to be higher than the risks calculated using SF and IUR estimates, they could be considerably lower. In addition, there are varying degrees of confidence in the weight of evidence for carcinogenicity of a given chemical. EPA (1986) has proposed a system for characterizing the overall weight of evidence based on the availability of animal, human, and other supportive data. The weight-of-evidence classification is an attempt to determine the likelihood that an agent is a human carcinogen and thus qualitatively affects the estimation of potential health risks. Three major factors are considered in characterizing the overall weight of evidence for human carcinogenicity:

- The availability and quality of evidence from human studies
- The availability and quality of evidence from animal studies
- Other supportive information that is assessed to determine whether the overall weight of evidence should be modified

Under EPA's risk assessment guidelines (1986, 1996, and 1999), classification of the overall weight of evidence has the following five categories:

- Group A - Human Carcinogen: There is at least sufficient evidence from human epidemiological studies to support a causal association between an agent and cancer.
- Group B - Probable Human Carcinogen: There is at least limited evidence from epidemiological studies of carcinogenicity in humans (Group B1), or, in the absence of adequate data in humans, there is sufficient evidence of carcinogenicity in animals (Group B2).
- Group C - Possible Human Carcinogen: There is inadequate evidence of carcinogenicity in humans.
- Group D - Not Classified: There are inadequate data or no existing data for the chemical.
- Group E - No Evidence of Carcinogenicity in Humans: There is no evidence for carcinogenicity in at least two adequate animal tests in different species, or in both epidemiological and animal studies.

The 2005 (EPA 2005a) Cancer Guidelines provides an update to the Cancer Guidelines (EPA 1986, 1996, and 1999). The 2005 Cancer Guidelines emphasize the value of understanding the biological changes that a chemical can cause and how these changes might lead to the development of cancer. They also discuss methods to evaluate and use such information, including information about an agent's postulated mode of action, or the series of steps and processes that lead to cancer formation. Mode-of-action data, when available and of sufficient quality, may be useful to draw conclusions about the potency of an agent, its potential effects at low doses, whether findings in animals are relevant to humans, and which populations or life stages may be particularly susceptible. In the absence of mode-of-action information, default options are available to allow the risk assessment to proceed.

The 2005 Guidelines recommend that an agent's human cancer potential be described in a weight-of-evidence narrative rather than the previously identified letter categories (A = known, B = probable, C = possible, D = not classifiable, and E = non-human carcinogen). The narrative summarizes the full range of available evidence and describes any conditions associated with conclusions about an agent's hazard potential. For example, the narrative may explain that an agent appears to be carcinogenic by some routes of exposure but not others (e.g., by inhalation but not ingestion). Similarly, a hazard may be attributed to exposures during sensitive life stages of development but not at other times. The narrative also summarizes uncertainties and key default options that have been invoked.

The following are the five recommended standard hazard descriptors:

- Carcinogenic to humans
- Likely to be carcinogenic to humans
- Suggestive evidence of carcinogenic potential
- Inadequate information to assess carcinogenic potential
- Not likely to be carcinogenic to humans

EPA is evaluating the carcinogenic weight of evidence of chemicals through the IRIS chemical process. In this process, chemicals are nominated, and all chemicals are evaluated consistent with the 2005 Guidelines and a narrative developed describing the Weight of Evidence. The IRIS chemical file is then reviewed, first through internal EPA consensus review and then external peer-review. The requirements for in-depth analysis of mode-of-action data and the review process do not allow the equating of a chemical evaluated under the old system with the letter classification using the 2005 Classification narrative; rather, a full analysis of the data is required.

The 2005 Cancer Guidelines also include Supplemental Guidance on the evaluation of early lifetime exposures including the mutagenic mode of action for carcinogenesis. The Supplemental Guidance provides procedures for evaluating chemicals that are carcinogens and either using the data in the development of the potency factors or using age dependent adjustment factors. For chemicals with mutagenic mode of action, the following ratio is applied to the chronic daily intake (EPA 2005b):

- Age 0 to less than 2 years: 10
- Age 2 to less than 16 years: 3
- Age greater than or equal to 16 years: 1

The Supplemental Guidance also provides for the evaluation of data on early lifetime exposures where children may be more susceptible. The application of these adjustments for specific chemicals is noted in the risk assessment and, where appropriate, in the presentation of calculated risks.

5.3 Toxicity Values

Tables 5-1 and 5-2 summarize the chronic RfDs and RfCs used to estimate noncancer effects. Tables 5-3 and 5-4 summarize the cancer SFs and IURs used to estimate cancer risks. These criteria are the most current data, obtained from the May 2016 on-line version of IRIS (EPA 2016b), PPRTVs provided by EPA Region 2, the November 2016 on-line version of Cal/EPA Office of Environmental Health Hazard Assessment (OEHHA) Toxicity Criteria Database (OEHHA 2016), and the November 2016 on-line version of ATSDR (ATSDR 2016). The use of surrogate toxicity values is noted in Tables 5-1 through 5-4. TCE is considered carcinogenic by a mutagenic mode of action for induction of kidney tumors, which means those exposed to TCE are assumed to have increased early-life (< 16 years of age) susceptibility to kidney tumors (EPA 2011b). Dose estimates for these mutagens are adjusted upward to include both early-life exposures that may result in the occurrence of cancer during childhood and early-life exposures that may contribute to cancers later in life.

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Section 6
Risk Characterization

In this section of the risk assessment, the human health risks potentially associated with the complete human exposure pathway identified in Section 4 are assessed. Potential risks due to exposures to COPCs in groundwater from the site are evaluated by integrating toxicity and exposure assessments into quantitative expressions of cancer risk and noncancer health hazards.

The potential for noncancer health effects is evaluated by comparing an exposure level over a specified time period with an RfD or RfC derived for a similar exposure period. This ratio of exposure to toxicity is referred to as a HQ. The Hazard Index (HI) is the sum of the HQs from individual chemicals and exposure routes. This HI assumes that there is a level of exposure below which it is unlikely even for sensitive populations to experience adverse health effects. If the HI exceeds unity (1), there may be concern for potential noncancer effects. However, this value should not be interpreted as a probability; generally, the greater the HI is above unity, the greater the level of concern.

Cancer risks are estimated as the incremental probability of an individual to develop cancer over a lifetime as a result of exposure to a potential carcinogen. The upper-bound excess lifetime cancer risk is estimated by multiplying the lifetime exposure estimated in the exposure assessment (Section 4) by the SF or IUR identified in the toxicity assessment (Section 5). Excess lifetime cancer risks are generally expressed in scientific notation and are probabilities. An excess lifetime cancer risk of 1×10^{-6} (one in one million), for example, represents the incremental probability that an individual will develop cancer as a result of exposure to a cancer chemical over a 70-year lifetime under specified exposure conditions. Because there are multiple cancer types for TCE but the finding of a mutagenic mode of action applies to kidney only, cancer risks from TCE are calculated to account for increased early-life susceptibility for kidney cancer and contribution from other cancer types (EPA 2011b).

In general, EPA recommends a noncancer HI value of unity (1) and a cancer risk range of 1×10^{-6} to 1×10^{-4} as threshold values for potential human health impacts. The results presented in the spreadsheet calculations are compared to these values. Risks based on CTE assumptions are calculated only if the cancer risk and/or noncancer health hazard calculations under the RME scenario exceed EPA's threshold values. These values aid in determining whether additional response action is necessary at the site.

6.1 Results of Risk Calculations

Risks for residents (adult and child) are estimated using RME assumptions. Risks are also estimated using CTE assumptions when the RME assumptions resulted in risk estimates above EPA's thresholds. The comparison of RME and CTE risks provides information about the degree to which variability in and uncertainty associated with receptor behavior (e.g., amount of water a child ingests per day) influence the risk estimates. CTE risks represent typical exposure patterns rather than an upper bound exposure that is reasonably expected to occur (i.e., RME). Cancer

risks from TCE are presented in Table B-7.0 in Appendix B and Table F-7.0 in Appendix F for RME and CTE scenarios, respectively. Cancer risk and noncancer health hazard calculations based on the RME scenario for all COPCs are presented in RAGS Part D Tables B-7.1 and B-7.2 and summarized in RAGS Part D Tables B-9 and B-10 series in Appendix B. Cancer risk and noncancer health hazard calculations based on the CTE scenario are presented in Appendix F. Cancer risk and noncancer health hazard estimates are summarized in Tables 6-1 and 6-2, respectively.

Residents could come into contact with contaminants in groundwater. Using data from the core of the plume, the total cancer risk for residents (1×10^{-2}) is above EPA's acceptable cancer risk range under the RME scenario. Cancer risks are due primarily to exposure to chromium (56%), VC (37%), TCE (5%), and benzo(b)fluoranthene (1%) in groundwater. Under the CTE scenario, the total cancer risk for residents (3×10^{-3}) remains above EPA's acceptable cancer risk range. Cancer risks are due primarily to exposure to chromium (62%), VC (30%), and TCE (5%) in groundwater.

Total noncancer HIs were evaluated for adult and child residents. Under the RME scenario, the total noncancer HIs for adult and child (110 and 106, respectively) are above EPA's threshold of unity. For the adult receptor, the target organ/effect HIs are greater than 1 for the kidney and liver (94), development, heart and immune system (93), lung (11), respiratory system (3), and body and organ weight and thyroid (2). RME HIs are primarily associated with potential exposure to TCE (93) and chromium (9) and to a lesser extent nickel (2), cobalt (1), cis-1,2-DCE (0.8), chlorobenzene (0.6), VC (0.4), and 1,2,3-trichlorobenzene (0.3). Under the CTE scenario for the adult, the total noncancer HI (18) is still above EPA's threshold of unity. The target organ/effect HIs for the liver and kidney (10), development, heart and immune system (9), and lung (6) are greater than 1. CTE values are primarily associated with potential exposure to TCE (9) and chromium (5) and to a lesser extent nickel (0.8), cobalt (0.6), cis-1,2-DCE (0.3), and antimony (0.2).

Under the RME scenario for the child, the total HI (106) is above EPA's threshold of unity. The target organ/effect HIs for the kidney and liver (81), development, heart and immune system (79), lung (18), respiratory system (6), body and organ weight and thyroid (3), and GI tract (2) are greater than 1. RME exposure values are primarily associated with potential exposure to TCE (79) and chromium (15) and to a lesser extent nickel (3), cobalt and iron (2), cis-1,2-DCE (1), antimony (0.7), chlorobenzene (0.5), VC (0.5), and 1,2,3-trichlorobenzene (0.5). Under the CTE scenario, the total noncancer HI (33) is still above EPA's threshold of unity. The target organ/effect HIs for the liver and kidney (17), development, heart and immune system (17), lung (11), respiratory system (3), and body and organ weight (2) are greater than 1. CTE values are primarily associated with potential exposure to TCE (17), and chromium (10) and to a lesser extent nickel (2), cobalt (1), cis-1,2-DCE (0.7), 1,2,3-trichlorobenzene (0.3), antimony (0.3), and VC (0.2).

6.2 Lead Evaluation

Lead was selected as a COPC in groundwater (Table 3-1) based on a maximum lead groundwater concentration of 22.8 µg/L in monitoring well MLS-7, which exceeded the lead Federal Action Level of 15 µg/L. The IEUBK model was used to assess exposure of contaminated groundwater for current/future child residents (Appendix E). The arithmetic average lead groundwater

concentration (10.2 µg/L) was used as the EPC in the model. Using all model defaults with the exception of the lead concentration in drinking water, the IEUBK model predicted that 0.76 percent (shown in the Figure in Appendix E as the area under the curve to the right of the vertical line which represents 10 µg/dL) of modeled child population would have blood lead concentrations that exceed the Centers for Disease Control and Prevention (CDC) level of concern for this scenario. EPA's risk reduction goal for contaminated sites is that no more than five percent of the population of children exposed to lead will have blood lead concentrations greater than 10 µg/dL. Based on the results of the IEUBK model (Appendix E), lead in groundwater is below levels of concern for child residents who may ingest contaminated groundwater at the tap.

6.3 Uncertainty in Risk Assessment

As in any risk assessment, the estimates of potential health threats (cancer risks and noncancer health hazards) have numerous associated uncertainties. The primary areas of uncertainty and limitations are qualitatively discussed here. The main areas of uncertainty in this HHRA include environmental data, exposure parameter assumptions, toxicological data, and risk characterization.

6.3.1 Environmental Data

Uncertainty is often associated with the estimation of chemical concentrations. Errors in the analytical data may stem from errors inherent in sampling and/or laboratory procedures. One of the most effective methods to minimize procedural or systematic error is to subject the data to a strict QC review. The QC review procedure helps to eliminate many laboratory errors. However, even with all data rigorously validated, it must be realized that error is inherent in all laboratory procedures.

Samples were collected from known and suspected areas of contamination (biased sampling) to delineate the nature and extent of contamination. Although this sampling methodology provided a reasonable estimation of the level of confidence at known or suspected contaminated areas within the site, the possibility exists that the data sets formed by these samples do not accurately represent the level of overall contamination at the site. The large number of samples collected at the site reduces uncertainty to an acceptable level in most cases.

Among the factors that should be considered is the ability to estimate risk in the future. The presumption that contaminant concentrations will remain the same over time may overestimate the potential risk because dispersion and natural attenuation processes may occur.

A ProUCL statistical outlier test was performed on chromium and nickel because the EPCs for these two metals are based on maximum sample results (i.e., their respective UCLs were greater than their maximum values). In additional, these maximum sample results, from multi-level bedrock well MSL-3 at a sample depth of 110-125 feet, are anomalously higher than any other groundwater result onsite (approximately 20 times higher for chromium and 40 times higher for nickel) and, therefore, may not be statistically representative of the actual site contamination. The maximum chromium concentration (622 µg/L) used as the EPC is two orders of magnitude and the maximum nickel concentration (1,260 µg/L) used as the EPC is three orders of magnitude above the next highest sample concentrations collected in November 2014 from other depths in the same well (1.5 J µg/L and 2.6 µg/L, respectively in MSL-3 at a sample depth of 215-230 feet).

Both chromium and nickel were not detected in the previous sampling round (April 2014) at the same location. MSL-3 is located in the core of the plume (northwest portion of Former Dump Area A).

The statistical outlier testing (Appendix G) concluded that both chromium and nickel sample results contained outliers from the same sample (MSL-3 from sample depth 110-125 feet). Replacing these two results with the lower sample results identified above, the outlier test was rerun with results showing no sample concentrations identified as outliers. Both cancer and noncancer risks were rerun for chromium and nickel using these lower sample results (Appendix H) with EPCs developed using the lower sample results for chromium and nickel and are summarized in the table below.

Metal	EPC (µg/L)	Lifetime Cancer Risk of Metal	Total Lifetime Cancer Risk
Chromium	622	6×10^{-3}	1×10^{-2}
Nickel	1260	NA	
Revised Chromium	38.2	4×10^{-4}	5×10^{-3}
Revised Nickel	26.13	NA	

Using the revised EPCs, the lifetime cancer risk for a current/future residential receptor potentially exposed to chromium was reduced from 6×10^{-3} to 4×10^{-4}. Nickel is not a carcinogen so cancer risk was not evaluated for this metal. The total lifetime can cancer risk for the current/future lifetime residential receptor was reduced from 1×10^{-2} to 5×10^{-3}, which still exceeds EPA's acceptable risk range of 1×10^{-6} to 1×10^{-4}.

Metal	EPC (µg/L)	Noncancer Health Hazards							
		Adult				Child			
		HI	Total HI Lung	Total HI Body/ Organ Weights	Total HI Resp. System	HI	Total Lung HI	Total HI Body/ Organ Weights	Total HI Resp. System
Chromium	622	9	11	NA	NA	10	18	NA	NA
Nickel	1260	2	NA	2	3	3	NA	3	6
Revised Chromium	38.2	0.6	2	NA	NA	0.9	4	NA	NA
Revised Nickel	26.13	0.04	NA	.04	1	0.07	NA	0.7	2

Using the revised EPCs from chromium, the current/future adult residential receptor HI was reduced from 9 to 0.6, which is below the noncancer health hazard index (HI) of unity (1). The HI for the target organ affected by exposure to chromium, the lung, was reduced from 11 to 2. The current/future child residential receptor HI was reduced from 18 to 4, which exceeds the noncancer health hazard HI of one. The total lung HI was reduced from 18 to 4.

When using the revised EPC for nickel, the current/future adult residential receptor HI was reduced from 2 to 0.4, which is below the noncancer health hazard index of one. The HIs for the

affected target organs, body and organ weights and the respiratory system, were reduced from 2 to 0.04 and 3 to 1, respectively. The current/future child residential receptor HI was reduced from 3 to 0.07, which is below the noncancer health hazard index of one. The HIs for the affected target organs, body and organ weights and the respiratory system, were reduced from 3 to 0.7 and 6 to 2, respectively.

Finally, some uncertainty is associated with the use of one round of sampling data (November 2014 data), which included elevated levels of chromium and nickel as described above. The use of at least two rounds of sampling is generally recommended (EPA 2014b) to be representative of current site conditions. However, several wells in the core of the plume have not been sampled more than once. The use of data from one round of sampling may over- or under-estimate long term average concentrations and associated risks.

6.3.2 Exposure Parameter Estimation

There are two major areas of uncertainty associated with exposure parameter estimation. The first relates to the calculation of EPCs. The second relates to parameter values used to estimate chemical intake.

6.3.2.1 Exposure Point Concentrations

A baseline risk assessment evaluates statistically-derived mean concentrations over an exposure area, considering all exposures within that area as equally possible. Risks associated with exposures are then assessed by combining the statistically-derived mean concentrations with exposure factors and the appropriate exposure/toxicity values to calculate potential risks and hazards. In accordance with EPA's recommendation as implemented in ProUCL (EPA 2015), when 5 or more samples are collected with a chemical detected in at least 4 samples, the EPC for a specific chemical in a particular medium is based on the 95 percent or higher UCL on the mean or the maximum detected concentration, whichever is less. Use of a 95 percent or higher UCL of the mean is simply to ensure that the average concentration is not underestimated. At this site, with only a maximum of 10 samples available for use in the EPC determinations, six contaminants were identified with less than four detections. The limited number of detections of 1,1,2,2-tetrachloroethane, 2,3,4,6-tetrachlorophenol, benzo(a)anthracene, benzo(b)fluoranthene, antimony, and thallium resulted in the use of the maximum detected concentrations as EPCs. While use of maximum concentrations may overestimate long-term exposures, the estimated cancer risks and noncancer HIs for residential receptors based on these EPCs were either at or below EPA thresholds.

When calculating EPCs from sampling data, any approach dealing with non-detected chemical concentrations is associated with some degree of uncertainty. This is because the non-detected result does not indicate whether the chemical is absent from the medium, present at a concentration just above zero, or present at a concentration just below the reporting limit. For chemicals that are infrequently detected, many of the values used to estimate the EPCs are based on reporting limits. High reporting limits for non-detects can lead to overestimation of risk if the actual concentrations are well below the reporting limit. However, reporting limits for the COPCs were generally toward the lower end of the detected concentrations, so the 95 percent or higher UCLs on the mean were minimally influenced by the reporting limits.

COPCs were identified in accordance with *Determining Groundwater Exposure Point Concentrations, Supplemental Guidance* (EPA 2014b), using the highest detected concentrations from multiple-level monitoring wells located in the core of the plume as described in Section 3.1 Sample Collection and Analysis. Although this approach focuses the risk evaluation on the COPCs located in or near the plume's center, it may not capture other site-related groundwater contaminants that may be located at the fringe or outside the plume and that exceed tap water RSLs. Therefore, screening of all the monitoring well data from all sampled dates and depths (data collected in 2014, 2015, and 2016 from MW-1 though MW-14 and MLS-1 through MLS-9 and MLS-11) against the tap water RSLs was conducted (see Table B-2.1b) to determine if there is any impact to COPC identification and overall risk results. The screening identified PCE, toluene, and the metals aluminum, arsenic, barium, and vanadium as additional contaminants to consider. PCE, toluene, aluminum, and vanadium each had only one detection that exceeded their respective RSLs. All remaining detected concentrations for these contaminants were below RSLs.

- PCE was detected in at a frequency of 35 detects out of 102 samples, with one detection of 4.7 µg/L in MSL-1 slightly exceeding its RSL of 4.1 µg/L.
- Toluene was detected in 58 out of 102 samples, with one detection of 200 µg/L in MLS-1 exceeding its RSL of 110 µg/L.
- Aluminum was detected at a frequency of 68 out of 103 samples, with one detection of 5290 µg/L in MW-4 exceeding its RSL of 2000 µg/L.
- Vanadium was detected at a frequency of 12 detects out of 103 samples, with the one detection of 15.6 µg/L in MW-4 exceeding its RSL of 8.6 µg/L .
- Arsenic was detected only three times out of 103 samples, with all detected concentrations (3.6 µg/L, 1.2 µg/L, and 1.3 µg/L in monitoring wells MW-4, MW-6, and MW-10, respectively) exceeding its RSL of 0.052 µg/L.
- Barium was detected in almost every sample, however, only two samples had concentrations that exceeded its RSL of 380 µg/L (970 µg/L inMW-9 and 390 µg/L in MW-10).

Thus, narrowing the monitoring wells to the ten included in this risk assessment (i.e., from the core of the plume) resulted in exclusion of several potential COPCs from the analysis, and an underestimate of risk in association with these chemicals. However, these contaminants were not detected frequently above their RSLs and would therefore not be expected to contribute much, if any, to risk estimates if the additional monitoring wells were included.

The compounds methylcyclohexane and 1,3-dichlorobenzene were detected in bedrock monitoring wells located in the core of the plume but they were not quantitatively evaluated in the risk assessment due to the lack of toxicity values. This lack of toxicity information may result in an under-estimate of risk. Methylcyclohexane was detected in one out of ten samples at a concentration of 1.3 µg/L in MW-1. The compound 1,3-diclorobenzene was detected in four out of ten samples, with the highest detected concentration of 1.5 µg/L in MW-1. These compounds were not detected in any residential wells sampled during the RI.

6.3.2.2 Exposure Parameters

Uncertainty is associated with the exposure parameter values used; however, assumptions are chosen to be conservative so as not to underestimate risk. For example, assumptions are made for the exposure time, frequency, and duration of potential chemical exposures, as well as for the quantity of material ingested, inhaled, or absorbed. In general, assumptions are made based on reasonable maximum exposures and, in most cases, values are specified by EPA Region 2, EPA guidance documents, or site-specific information.

The choices made for exposure parameters are protective and are unlikely to underestimate risks. Due to this, cancer risks and health hazards could be overestimated based on use of conservative exposure parameters in estimating risks.

Vapor concentrations in bathrooms were modeled using the shower model. The model is very conservative; thus, this approach tends to produce conservative indoor air concentrations that could result in overestimation of actual risk to future residents.

6.3.3 Toxicity Values

A potentially large source of uncertainty is inherent in the derivation of the EPA toxicity values (i.e., RfDs, RfCs, SFs, and IURs). In many cases, data are extrapolated from animals to sensitive humans by the application of uncertainty factors to an estimated NOAEL or lowest-observed-adverse-effect level (LOAEL) for noncancer health effects. While designed to be protective, it is likely in many cases that uncertainty factors overestimate the magnitude of differences that may exist between humans and animals, and among humans. Alternatively, toxicity criteria may be based on studies that did not detect the most sensitive adverse effects. For example, many studies have not measured possible toxic effects on the immune system. Moreover, some chemicals may cause subtle effects not easily recognized in animal studies. The effects of lead on cognitive function and behavior at very low levels of exposure serve as examples.

In addition, derivation of cancer SFs often involves linear extrapolation of effects at high doses to potential effects at lower doses commonly seen in environmental exposure settings. Currently, it is not known whether linear extrapolation is appropriate. It is probable that the shape of the dose response curve for carcinogenesis varies with different chemicals and mechanisms of action. It is not possible at this time, however, to describe such differences in quantitative terms. It is likely that the assumption of linearity is conservative and yields SFs that are unlikely to lead to underestimation of risks. Yet, for specific chemicals, current methodology could cause SFs and, hence, risks to be over- or underestimated.

Furthermore, toxicity values are often based on observed dose-response relationships when the chemical is dissolved in water or is in some other readily soluble form. For instance, the oral SF for arsenic is based on exposure of a large Taiwanese population to dissolved arsenic in drinking water. In this risk assessment, intakes are not adjusted for relative bioavailability, which most likely overestimate risks.

Chromium in groundwater contributed about 56% of the estimated cancer risk for current/future residents. Chromium can exist in several oxidation states ranging from chromium (II) to hexavalent chromium (VI). Only two oxidation states, chromium (III) and chromium (VI), are widely studied because of their predominance and stability in the ambient environment and their

toxicological characteristics. Chromium (III) is poorly absorbed, regardless of the route of exposure, whereas chromium (VI) is more readily absorbed. Toxicological studies show that chromium (VI) is generally more toxic than chromium (III). Chromium (VI) is classified as a Group A - known human carcinogen by the inhalation route of exposure (EPA 2015). This risk assessment utilized an oral SF of 0.5 per mg/kg-day for chromium (VI) developed by the New Jersey Department of Environmental Protection. Total chromium, not valence-specific, data was collected from the site. In the absence of valence-specific data, total chromium is evaluated in the HHRA using the chromium (VI) toxicity criteria. This assumption is very conservative since chromium in the environment is generally dominated by the much less toxic trivalent form. Thus, the use of chromium (VI) toxicity values overestimates the risk attributed to total chromium.

6.3.4 Risk Characterization

There is also uncertainty in assessing the risks associated with a mixture of chemicals. In this assessment, the effects of exposure to each contaminant present have initially been considered separately. However, these substances occur together at the site, and individuals may be exposed to mixtures of the chemicals. Predictions of how these mixtures of chemicals will interact must be based on an understanding of the mechanisms of such interactions. Individual chemicals may interact chemically in the body, yielding a new toxic component or causing different effects at different target organs. Suitable data are not currently available to rigorously characterize the effects of chemical mixtures. Consequently, as recommended by EPA (1989), chemicals present at the site are assumed to act additively, and potential health risks are evaluated by summing excess lifetime cancer risks and calculating HIs for noncancer health effects.

This approach to assessing risk associated with mixtures of chemicals assumes that there are no synergistic or antagonistic interactions among the chemicals and that all chemicals have the same toxic endpoint and mechanisms of action. To the extent that these assumptions are correct, the actual risks could be underestimated or overestimated.

As a result of the uncertainties described above, the risk assessment should be viewed as presenting an estimate of the potential risks and hazards associated with exposure to contaminated media. The results provide a conservative analysis intended to indicate the potential for adverse impacts to occur based on the RME and CTE scenarios.

Section 7
Summary and Conclusions

7.1 Approach

COPCs are identified based on criteria outlined in RAGS (EPA 1989), primarily through comparison of maximum detected concentrations to risk-based screening levels, followed by quantitative assessment of noncancer hazards and cancer risks.

In the HHRA, contaminants in groundwater at the site are evaluated for potential health threats to current and future residents. Exposure routes are identified and quantitative estimates of the magnitude, frequency, and duration of exposure are made. Exposure point concentrations are estimated using the lower of the UCL and the maximum detected concentration. Daily intakes are calculated based on the RME scenario (the highest exposure reasonably expected to occur at a site). The intent is to estimate a conservative exposure case that is still within the range of possible exposures. CTE assumptions are also developed, which reflect more typical exposures.

In the toxicity assessment, current toxicological human health data (i.e., RfDs, RfCs, SFs, and IURs) are obtained from various sources and are utilized in the order specified by EPA (2003).

Risk characterization involves integrating the exposure and toxicity assessments into quantitative expressions of risks/health effects. Specifically, daily intakes are compared with concentrations known or suspected to present health risks or hazards. The estimates of cancer risk and noncancer health hazards, and the greatest chemical contributors to these estimates, are identified.

In general, EPA recommends an acceptable cancer risk range of 1×10-6 to 1×10-4 and noncancer HI of unity as threshold values for potential human health impacts (EPA 1989). These values aid in determining whether additional response action is necessary at the site.

7.2 Summary of Risks

This section presents a summary of the cancer risks and noncancer health hazards for exposures to contaminants in groundwater at the site that are quantitatively evaluated for potential health threats.

7.2.1 Cancer Risk

The total cancer risk estimates for the RME scenario are listed below. When RME risks exceed EPA's acceptable range of 1×10^{-6} to 1×10^{-4}, CTE risks are also provided.

- Current & Future Land-Use Scenario
    - Residents: RME: 1×10^{-2}; CTE: 3×10^{-3}

Based on the results above, estimated cancer risks for residents are above EPA's threshold of 1×10^{-4} for the RME and CTE scenarios, primarily due to chromium, VC, and TCE in groundwater.

The cancer risk may be overestimated because it was assumed that all of the chromium is in the more toxic hexavalent form. However, if chromium were assumed to be present in its trivalent form, the total risk from other carcinogens (5×10^{-3} for RME and 1×10^{-3} for CTE) would still exceed EPA's threshold of 1×10^{-4}.

In addition, the cancer risk may be overestimated because the maximum chromium concentration used in the risk calculation is an outlier. When that outlier is replaced with the next highest concentration detected in the well, and assuming the chromium is in the hexavalent form, the total risk from all carcinogens again decreases to 5×10^{-3} for RME and 1×10^{-3} for CTE and would still exceed EPA's threshold of 1×10^{-4}.

7.2.2 Noncancer Health Hazard

HIs greater than 1 indicate the potential for noncancer health hazards. The estimated organ/effect HIs for the RME scenario are listed below. Organ/effect HIs for the CTE scenario are also provided when those for the RME scenario exceed unity.

- Current & Future Land-Use Scenario
  - Residents:
    - *RME Adult Total HI: 110, HIs above 1 for kidney, liver, heart, immune system, development, lung, respiratory system, body and organ weight, and thyroid.*
    - *CTE Adult Total HI: 18, HIs are still above 1 for kidney, liver, heart, immune system, development, and lung.*
    - *RME Child Total HI: 106, HIs above 1 for kidney, liver, heart, immune system, development, lung, respiratory system, body and organ weight, thyroid, and GI tract.*
    - *CTE Child Total HI: 33, HIs are still above 1 for above 1 for kidney, liver, heart, immune system, development, lung, respiratory system, and body and organ weight.*

Based on the results above, the total HIs for future residents are above 1 for both the RME and CTE scenarios, and are driven primarily by potential exposure to TCE and chromium in groundwater, and to a lesser extent by nickel, cobalt, and cis-1,2-DCE. Exposure to high concentrations of TCE can impact several organ systems, and elevated HIs for the following organs/effects are primarily the result of exposure to TCE in groundwater: kidney, liver, heart, immune system, and development.

7.2.3 Lead Evaluation

Lead was selected as a COPC in groundwater based on its maximum groundwater concentration exceeding the lead Federal Action Level. The IEUBK model is used to assess exposure of contaminated groundwater for current/future child residents using the arithmetic mean lead groundwater concentration as the EPC in the model and model default values. EPA's risk reduction goal for contaminated sites is that no more than five percent of the population of children exposed to lead will have blood lead concentrations greater than 10 µg/dL. Based on the results of the IEUBK model, lead in groundwater is below levels of concern for child residents who may ingest contaminated groundwater at the tap.

7.3 Conclusions

Elevated potential risks/hazards were only identified for current/future residents assumed to use untreated impacted groundwater from the core of the plume at the site. Cancer risks for current/future residents exceed EPA's acceptable cancer risk range mainly due to chromium, VC, and TCE in groundwater. When an outlier concentration of chromium is excluded from the calculations, cancer risks for current/future residents still exceed EPA's acceptable cancer risk range, again mainly due to chromium, VC, and TCE in groundwater. When a more typical exposure (calculated using average or median exposure factor values when available rather than RME exposure factor values) is considered under the CTE scenario, cancer risks for current/future residents still exceed the acceptable cancer risk range.

For noncancer hazards, the total HIs for current/future residents using untreated impacted groundwater are above EPA's threshold of unity at the site under both the RME and CTE scenarios and are driven primarily by potential exposure to TCE and chromium in groundwater, and to a lesser extent by nickel, cobalt, and cis-1,2-DCE. When outlier concentrations of chromium and nickel are excluded from the calculations, total HIs still exceed EPA's threshold of unity, mainly due to TCE in groundwater, and to a lesser extent cobalt and cis-1,2-DCE.

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Section 8
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Tables

TABLE 3-1
LEAD WORKSHEET
Site Name: Mansfield Trail Dump Site, OU1, Byram Township, New Jersey
Receptor: Resident Adult and Child [Birth to <6 years]

A. EXPOSURE SCENARIO: RESIDENTIAL

1. Lead Screening Questions

Medium	Maximum Concentration		Screening Level		Basis for Screening Level Value
	Value	Unit	Value	Unit	
Groundwater	22.8	µg/L	15	µg/L	Federal Action Level for Lead

Note: If the Adult Lead Model is used, designate the baseline blood lead level and geometric standard deviation used to calculate the screening level.

2. Lead Model Questions

Question	Response for Residential Lead Model
Was a lead model used? (If "no" explain rationale)	Yes. The maximum lead concentration in groundwater (22.8 µg/L) exceeds the Federal Action Level of 15 µg/L. Therefore, further analysis using a lead model is warranted.
Which lead model and what version/date was used?	IEUBK (win v1.1, build 11)
Where are the input values located in the risk assessment report?	Appendix E
Where are the output values located in the risk assessment report?	Appendix E
Was the model run using default values only?	Yes, except for the lead concentration in drinking water (using arithmetic mean of 10.2 µg/L calculated for lead using ProUCL statistical software (see Appendix C).
If non-default values were used, where are the rationale for those values located in the risk assessment report?	NA

TABLE 3-1
LEAD WORKSHEET
Site Name: Mansfield Trail Dump Site, OU1, Byram Township, New Jersey
Receptor: Resident Adult and Child [Birth to <6 years]

3. Final Result

Medium	Result	Comment
Groundwater	NA	NA

TABLE 3-1
LEAD WORKSHEET
Site Name: Mansfield Trail Dump, OU1, Byram Township, New Jersey
Receptor: Worker (Adult), Construction Worker (Adult), Recreational User (Adolescent [12 to <18 years])

B. EXPOSURE SCENARIO: NON-RESIDENTIAL

1. Lead Screening Questions

Medium	Maximum Concentration		Screening Level		Basis for Screening Level Value
	Value	Unit	Value	Unit	
Groundwater	NA	NA	NA	NA	A non-residential exposure scenario is not applicable.

Note: If the Adult Lead Model is used, designate the baseline blood lead level and geometric standard deviation used to calculate the screening level.

2. Lead Model Questions

Question	Response for Non-Residential Lead Model
Was a lead model used? (If "no" explain rationale)	NA
Which lead model and what version/date was used?	NA
Where are the input values located in the risk assessment report?	NA
Where are the output values located in the risk assessment report?	NA
Was the model run using default values only?	NA
If non-default values were used, where are the rationale for those values located in the risk assessment report?	NA

3. Final Result

Medium	Result	Comment
NA	NA	NA

TABLE 3-2
LIST OF CHEMICALS OF POTENTIAL CONCERN
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

Chemicals Detected in Groundwater	COPC
Volatile Organic Compounds	
1,1,1-Trichloroethane	No
1,1,2,2-Tetrachloroethane	**Yes**
1,1-Dichloroethane	**Yes**
1,1-Dichloroethene	No
1,2,3-Trichlorobenzene	**Yes**
1,2,4-Trichlorobenzene	No
1,2-Dichlorobenzene	No
1,2-Dichloroethane	**Yes**
1,3-Dichlorobenzene	No
1,4-Dichlorobenzene	**Yes**
2-Butanone	No
Acetone	No
Benzene	**Yes**
Bromochloromethane	No
Bromodichloromethane	**Yes**
Carbon Disulfide	No
Chlorobenzene	**Yes**
Chloroethane	No
Chloroform	**Yes**
Chloromethane	No
cis-1,2-Dichloroethene	**Yes**
Cyclohexane	No
Isopropylbenzene	No
Methylcyclohexane	No
Methylene Chloride	No
o-Xylene	No
Tetrachloroethene	No
Toluene	No
trans-1,2-Dichloroethene	No
Trichloroethene	**Yes**
Vinyl Chloride	**Yes**
Semi-volatile Organic Compounds	
1,4-Dioxane	**Yes**
2,3,4,6-Tetrachlorophenol	**Yes**
2-Methylnaphthalene	No
Acenaphthene	No
Acenaphthylene	No
Benzo(a)anthracene	**Yes**
Benzo(b)fluoranthene	**Yes**
Bis(2-Ethylhexyl)Phthalate	**Yes**
Chrysene	No
Diethylphthalate	No
Naphthalene	**Yes**
Phenanthrene	No
Inorganics	
Aluminum	No
Antimony	**Yes**
Barium	No
Beryllium	No
Cadmium	No
Calcium	No
Chromium	**Yes**
Cobalt	**Yes**
Copper	No
Iron	**Yes**
Lead	**Yes**
Magnesium	No
Manganese	**Yes**
Nickel	**Yes**
Potassium	No
Selenium	No
Sodium	No
Thallium	**Yes**
Vanadium	No
Zinc	No
Total number of COPCs:	26

Yes = Selected as COPC

No = Not Selected as COPC

Table 4-1
Selection of Exposure Pathways
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor (Age)	Exposure Route	Type of Analysis [1]	Rationale for Selection or Exclusion of Exposure Pathway
Current/Future	Groundwater	Groundwater	Tap Water	Resident	Adult and Child (birth to <6 years)	Ingestion	Quant	Residents are currently using groundwater pumped from their domestic wells for all their household needs and may continue to use the groundwater from these wells in the future in the absence of any remediation.
						Dermal	Quant	
						Inhalation	Quant	

Note:
[1] Quant = Quantitative risk analysis performed.

TABLE 5-1
NONCANCER TOXICITY DATA - ORAL/DERMAL
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

Chemical of Potential Concern	Chronic/ Subchronic	Oral RfD		Oral Absorption Efficiency for Dermal [1]	Absorbed RfD for Dermal [2]		Primary Target Organ	Combined Uncertainty/ Modifying Factor	Source	Date [3]
		Value	Unit		Value	Unit				
Volatile Organic Compounds										
1,1,2,2-Tetrachloroethane	Chronic	2.0E-02	mg/kg-day	1	2.0E-02	mg/kg-day	Liver	1000	IRIS	11/12/2016
1,1-Dichloroethane	Chronic	2.0E-01	mg/kg-day	1	2.0E-01	mg/kg-day	Kidney	3,000	PPRTV	9/27/2006
1,2,3-Trichlorobenzene	Chronic	8.0E-04	mg/kg-day	1	8.0E-04	mg/kg-day	Body Weight/Liver/Thyroid	10000	PPRTV-S	9/11/2009
1,2-Dichloroethane	Chronic	6.0E-03	mg/kg-day	1	6.0E-03	mg/kg-day	Kidney	10000	PPRTV-S	10/1/2010
1,4-Dichlorobenzene	Chronic	7.0E-02	mg/kg-day	1	7.0E-02	mg/kg-day	Liver	100	ATSDR	12/1/2016
Benzene	Chronic	4.0E-03	mg/kg-day	1	4.0E-03	mg/kg-day	Blood	300	IRIS	11/12/2016
Bromodichloromethane	Chronic	2.0E-02	mg/kg-day	1	2.0E-02	mg/kg-day	Liver	1,000	IRIS	11/12/2016
Chlorobenzene	Chronic	2.0E-02	mg/kg-day	1	2.0E-02	mg/kg-day	Liver	1000	IRIS	11/12/2016
Chloroform	Chronic	1.0E-02	mg/kg-day	1	1.0E-02	mg/kg-day	Liver	100	IRIS	11/12/2016
cis-1,2-Dichloroethene	Chronic	2.0E-03	mg/kg-day	1	2.0E-03	mg/kg-day	Kidney	3,000	IRIS	11/12/2016
Trichloroethene	Chronic	5.0E-04	mg/kg-day	1	5.0E-04	mg/kg-day	Heart/ Immune System/ Developmental/Kidney	10 to 1,000	IRIS	11/12/2016
Vinyl Chloride	Chronic	3.0E-03	mg/kg-day	1	3.0E-03	mg/kg-day	Liver	30	IRIS	11/12/2016
Semi-volatile Organic Compounds										
1,4-Dioxane	Chronic	3.0E-02	mg/kg-day	1	3.0E-02	mg/kg-day	Liver/Kidney	300	IRIS	11/12/2016
2,3,4,6-Tetrachlorophenol	Chronic	3.0E-02	mg/kg-day	1	3.0E-02	mg/kg-day	Liver	1000	IRIS	11/12/2016
Benzo(a)anthracene	Chronic	NA	NA	1	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	Chronic	NA	NA	1	NA	NA	NA	NA	NA	NA
Bis(2-Ethylhexyl)Phthalate	Chronic	2.0E-02	mg/kg-day	1	2.0E-02	mg/kg-day	Liver	1,000	IRIS	11/12/2016
Naphthalene	Chronic	2.0E-02	mg/kg-day	1	2.0E-02	mg/kg-day	Body Weight	3000	IRIS	11/12/2016
Inorganics										
Antimony	Chronic	4.0E-04	mg/kg-day	0.15	6.0E-05	mg/kg-day	Longevity/Blood	1,000	IRIS	11/12/2016
Chromium[4]	Chronic	3.0E-03	mg/kg-day	0.025	7.5E-05	mg/kg-day	None reported	300	IRIS	11/12/2016
Cobalt	Chronic	3.0E-04	mg/kg-day	1	3.0E-04	mg/kg-day	Thyroid	3,000	PPRTV	8/25/2008
Iron	Chronic	7.0E-01	mg/kg-day	1	7.0E-01	mg/kg-day	GI Tract	1.5	PPRTV	9/11/2006
Lead	Chronic	NA	NA	1	NA	NA	NA	NA	NA	NA
Manganese	Chronic	1.4E-01	mg/kg-day	1	1.4E-01	mg/kg-day	CNS	1	IRIS	11/12/2016
Nickel[5]	Chronic	2.0E-02	mg/kg-day	0.04	8.0E-04	mg/kg-day	Body and Organ Weight	200	IRIS	12/1/2016
Thallium	Chronic	1.0E-05	mg/kg-day	1	1.0E-05	mg/kg-day	Skin/Hair	3,000	PPRTV-S	10/25/2012

[1] Oral Absorption Efficiency for Dermal from Regional Screening Levels, May 2016
http://www.epa.gov/risk/risk-based-screening-table-generic-tables

[2] Adjusted RfD for Dermal = Oral RfD x Oral Absorption Efficiency for Dermal.

[3] Date shown for IRIS is the date IRIS was searched. http://www.epa.gov/iris/
Date shown for other sources is the publication date.

[4] based on chromium (VI)

[5] based on nickel, soluble salt

Definition:
ATSDR = Agency for Toxic Substances and Disease Registry
CNS = central nervous system
GI = gastrointestinal
IRIS = Integrated Risk Information System
mg/kg-day = milligram per kilogram per day
NA = not available
PPRTV-S = Screening Provisional Peer Reviewed Toxicity Value
PPRTV = Provisional Peer Reviewed Toxicity Value
RfD = reference dose

TABLE 5-2
NONCANCER TOXICITY DATA - INHALATION (CHRONIC)
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

Chemical of Potential Concern	Inhalation RfC		Primary Target Organ	Combined Uncertainty/ Modifying Factor	RfC Target Organ	
	Value	Unit			Source	Date [1]
Volatile Organic Compounds						
1,1,2,2-Tetrachloroethane	NA	NA	NA	NA	NA	NA
1,1-Dichloroethane	NA	NA	NA	NA	NA	NA
1,2,3-Trichlorobenzene	NA	NA	NA	NA	NA	NA
1,2-Dichloroethane	7.0E-03	mg/m^3	Liver	3000	PPRTV	10/1/2010
1,4-Dichlorobenzene	8.0E-01	mg/m^3	Liver	100	IRIS	11/12/2016
Benzene	3.0E-02	mg/m^3	Blood	300	IRIS	11/12/2016
Bromodichloromethane	NA	NA	NA	NA	NA	NA
Chlorobenzene	5.0E-02	mg/m^3	Liver/Kidney	1000	PPRTV	10/12/2006
Chloroform	3.0E-01	mg/m^3	Alimentary System/Kidney/Developmental	300	Cal/EPA	6/1/2014
cis-1,2-Dichloroethene	NA	NA	NA	NA	NA	NA
Trichloroethene	2.0E-03	mg/m^3	Heart/Immune System/Liver	10 to 100	IRIS	11/12/2016
Vinyl Chloride	1.0E-01	mg/m^3	Liver	30	IRIS	11/12/2016
Semi-volatile Organic Compounds						
1,4-Dioxane	3.0E-02	mg/m^3	CNS/Respiratory System	1000	IRIS	11/12/2016
2,3,4,6-Tetrachlorophenol	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	NA	NA	NA	NA	NA	NA
Bis(2-Ethylhexyl)Phthalate	NA	NA	NA	NA	NA	NA
Naphthalene	3.0E-03	mg/m^3	CNS/Respiratory System	3000	IRIS	11/12/2016
Inorganics						
Antimony[2]	2.0E-04	mg/m^3	Lung	300	IRIS	11/10/2016
Chromium[3]	1.0E-04	mg/m^3	Lung	300	IRIS	11/12/2016
Cobalt	6.0E-06	mg/m^3	Respiratory Tract/Lung	300	PPRTV	8/25/2008
Iron	NA	NA	NA	NA	NA	NA
Lead	NA	NA	NA	NA	NA	NA
Manganese	5.0E-05	mg/m^3	CNS	1,000	IRIS	11/12/2016
Nickel	1.4E-05	mg/m^3	Respiratory System	100	Cal/EPA	6/1/2014
Thallium	NA	NA	NA	NA	NA	NA

[1] Date shown for IRIS is the date IRIS was searched. http://www.epa.gov/iris/
Date shown for other sources is the publication date.

[2] based on antimony trioxide

[3] based on chromium (VI) particulates

Definition:
Cal/EPA = California Environmental Protection Agency
CNS = central nervous system
IRIS = Integrated Risk Information System
mg/m^3 = milligram per cubic meter
NA = not available
PPRTV = Provisional Peer Reviewed Toxicity Value
RfC = reference concentration

TABLE 5-3
CANCER TOXICITY DATA - ORAL/DERMAL
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

Chemical of Potential Concern	Oral Slope Factor		Oral Absorption Efficiency for Dermal [1]	Absorbed Slope Factor for Dermal [2]		Mutagen [3]	Weight of Evidence/ Cancer Guideline Description	Source	Date [4]
	Value	Unit		Value	Unit				
Volatile Organic Compounds									
1,1,2,2-Tetrachloroethane	2.0E-01	$(mg/kg\text{-}day)^{-1}$	1	2.0E-01	$(mg/kg\text{-}day)^{-1}$	--	Likely to be carcinogenic to humans	IRIS	11/12/2016
1,1-Dichloroethane	5.7E-03	$(mg/kg\text{-}day)^{-1}$	1	5.7E-03	$(mg/kg\text{-}day)^{-1}$	--	C	Cal/EPA	7/21/2009
1,2,3-Trichlorobenzene	NA	NA	1	NA	NA	--	NA	NA	NA
1,2-Dichloroethane	9.1E-02	$(mg/kg\text{-}day)^{-1}$	1	9.1E-02	$(mg/kg\text{-}day)^{-1}$	--	B2	IRIS	11/12/2016
1,4-Dichlorobenzene	5.4E-03	$(mg/kg\text{-}day)^{-1}$	1	5.4E-03	$(mg/kg\text{-}day)^{-1}$	--	2B	Cal/EPA	7/21/2009
Benzene	5.5E-02	$(mg/kg\text{-}day)^{-1}$	1	5.5E-02	$(mg/kg\text{-}day)^{-1}$	--	A	IRIS	11/12/2016
Bromodichloromethane	6.2E-02	$(mg/kg\text{-}day)^{-1}$	1	6.2E-02	$(mg/kg\text{-}day)^{-1}$	--	B2	IRIS	11/12/2016
Chlorobenzene	NA	NA	1	NA	NA	--	D	IRIS	11/12/2016
Chloroform	3.1E-02	$(mg/kg\text{-}day)^{-1}$	1	3.1E-02	$(mg/kg\text{-}day)^{-1}$	--	B2	Cal/EPA	2011
cis-1,2-Dichloroethene	NA	NA	1	NA	NA	--	inadequate information to assess the carcinogenic potential	IRIS	11/12/2016
Trichloroethene[5]	4.6E-02	$(mg/kg\text{-}day)^{-1}$	1	4.6E-02	$(mg/kg\text{-}day)^{-1}$	M	carcinogenic to humans	IRIS	11/12/2016
Vinyl Chloride[6]	7.2E-01	$(mg/kg\text{-}day)^{-1}$	1	7.2E-01	$(mg/kg\text{-}day)^{-1}$	M	A	IRIS	11/12/2016
Semi-volatile Organic Compounds									
1,4-Dioxane	1.0E-01	$(mg/kg\text{-}day)^{-1}$	1	1.0E-01	$(mg/kg\text{-}day)^{-1}$	--	Likely to be carcinogenic to humans	IRIS	11/12/2016
2,3,4,6-Tetrachlorophenol	NA	NA	1	NA	NA	--	NA	NA	NA
Benzo(a)anthracene	7.3E-01	$(mg/kg\text{-}day)^{-1}$	1	7.3E-01	$(mg/kg\text{-}day)^{-1}$	M	B2	EPA	7/1/1993
Benzo(b)fluoranthene	7.3E-01	$(mg/kg\text{-}day)^{-1}$	1	7.3E-01	$(mg/kg\text{-}day)^{-1}$	M	B2	EPA	7/1/1993
Bis(2-Ethylhexyl)Phthalate	1.4E-02	$(mg/kg\text{-}day)^{-1}$	1	1.4E-02	$(mg/kg\text{-}day)^{-1}$	--	B2	IRIS	11/12/2016
Naphthalene	NA	NA	1	NA			C	IRIS	11/12/2016
Inorganics									
Antimony	NA	NA	0.15	NA	NA	--	NA	NA	NA
Chromium[7]	5.0E-01	$(mg/kg\text{-}day)^{-1}$	0.025	2.0E+01	$(mg/kg\text{-}day)^{-1}$	--	likely to be carcinogenic to humans	NJDEP	4/8/2009
Cobalt	NA	NA	1	NA	NA	--	NA	NA	NA
Iron	NA	NA	1	NA	NA	--	inadequate information to assess the carcinogenic potential	PPRTV	9/11/2006
Lead	NA	NA	1	NA	NA	--	B2	IRIS	11/12/2016
Manganese	NA	NA	0.04	NA	NA	--	D	IRIS	11/12/2016
Nickel	NA	NA	0.04	NA	NA	--	NA	NA	NA
Thallium	NA	NA	1	NA	NA	--	inadequate information to assess the carcinogenic potential	PPRTV	10/25/2012

TABLE 5-3
CANCER TOXICITY DATA - ORAL/DERMAL
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

(1) Oral Absorption Efficiency for Dermal from Regional Screening Levels, May 2016
http://www.epa.gov/risk/risk-based-screening-table-generic-tables

(2) Absorbed slope factor (SF) for Dermal = Oral SF / Oral Absorption Efficiency for Dermal

(3) Identified as a mutagen on the Regional Screening Level Table, May 2016

(4) Date shown for IRIS is the date IRIS was searched. http://www.epa.gov/iris/
Date shown for other sources is the publication date.

(5) TCE is considered carcinogenic by a mutagenic mode of action for induction of kidney tumors.
The adult-based oral SF for kidney cancer is 9.3×10^{-3} per mg/kg/day

(6) Oral SF listed is based on continuous lifetime exposure during adulthood.
The oral SF for the continuous lifetime exposure from birth is 1.5 per mg/kg/day.

(7) based on chromium (VI)

Definition:
Cal/EPA = California Environmental Protection Agency
EPA = United States Environmental Protection Agency
IRIS = Integrated Risk Information System
M = mutagen
mg/kg-day = milligram per kilogram per day
NA = not available
NJDEP = New Jersey Department of Environmental Protection
PPRTV = Provisional Peer Reviewed Toxicity Value

EPA Weight of Evidence (EPA 1986, EPA 1996):
A - Human carcinogen
B1 - Probable human carcinogen
indicates that limited human data are available
B2 - Probable human carcinogen - indicates sufficient evidence in
animals and inadequate or no evidence in humans
C - Possible human carcinogen
D - Not classifiable as human carcinogen

EPA Weight of Evidence Narrative (EPA 2005):
Carcinogenic to human
Likely to be carcinogenic to humans
Suggestive evidence of carcinogenic potential
Inadequate information to assess carcinogenic potential
Not likely to be carcinogenic to humans

TABLE 5-4
CANCER TOXICITY DATA - INHALATION
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

Chemical of Potential Concern	Inhalation Unit Risk		Mutagen [1]	Weight of Evidence/ Cancer Guideline Description	Inhalation Unit Risk	
	Value	Unit			Source	Date [2]
Volatile Organic Compounds						
1,1,2,2-Tetrachloroethane	5.8E-05	$(\mu g/m^3)^{-1}$	--	Likely to be carcinogenic to humans	Cal/EPA	7/21/2009
1,1-Dichloroethane	1.6E-06	$(\mu g/m^3)^{-1}$	--	C	Cal/EPA	7/21/2009
1,2,3-Trichlorobenzene	NA	NA	--	NA	NA	NA
1,2-Dichloroethane	2.6E-05	$(\mu g/m^3)^{-1}$	--	B2	IRIS	11/12/2016
1,4-Dichlorobenzene	1.1E-05	$(\mu g/m^3)^{-1}$	--	2B	Cal/EPA	7/21/2009
Benzene	7.8E-06	$(\mu g/m^3)^{-1}$	--	A	IRIS	11/12/2016
Bromodichloromethane	3.7E-05	$(\mu g/m^3)^{-1}$	--	B2	Cal/EPA	6/1/2009
Chlorobenzene	NA	NA	--	D	IRIS	11/12/2016
Chloroform	2.3E-05	$(\mu g/m^3)^{-1}$	--	B2	IRIS	11/12/2016
cis-1,2-Dichloroethene	NA	NA	--	inadequate information to assess the carcinogenic potential	IRIS	11/12/2016
Trichloroethene[3]	4.1E-06	$(\mu g/m^3)^{-1}$	M	carcinogenic to humans	IRIS	11/12/2016
Vinyl Chloride[4]	4.4E-06	$(\mu g/m^3)^{-1}$	M	A	IRIS	11/12/2016
Semi-volatile Organic Compounds						
1,4-Dioxane	5.0E-06	$(\mu g/m^3)^{-1}$	--	Likely to be carcinogenic to humans	IRIS	11/12/2016
2,3,4,6-Tetrachlorophenol	NA	NA	--	NA	NA	NA
Benzo(a)anthracene	1.1E-04	$(\mu g/m^3)^{-1}$	M	B2	Cal/EPA	6/1/2009
Benzo(b)fluoranthene	1.1E-04	$(\mu g/m^3)^{-1}$	M	B2	Cal/EPA	6/1/2009
Bis(2-Ethylhexyl)Phthalate	2.4E-06	$(\mu g/m^3)^{-1}$	--	B2	Cal/EPA	7/29/2009
Naphthalene	3.4E-05	$(\mu g/m^3)^{-1}$		C	Cal/EPA	7/21/2009
Inorganics						
Antimony	NA	NA	--	NA	NA	NA
Chromium[5]	1.2E-02	$(\mu g/m^3)^{-1}$	--	A	IRIS	11/12/2016
Cobalt	9.0E-03	$(\mu g/m^3)^{-1}$	--	likely to be carcinogenic to humans	PPRTV	8/25/2008
Iron	NA	NA	--	inadequate information to assess the carcinogenic potential	PPRTV	9/11/2006
Lead	NA	NA	--	B2	IRIS	11/12/2016
Manganese	NA	NA	--	D	IRIS	11/12/2016
Nickel[6]	2.4E-04	$(\mu g/m^3)^{-1}$	--	A	IRIS	11/12/2016
Thallium	NA	NA	--	inadequate information to assess the carcinogenic potential	PPRTV	10/25/2012

TABLE 5-4
CANCER TOXICITY DATA - INHALATION
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

(1) Identified as a mutagen on the Regional Screening Level (RSL) Table, May 2016, http://www.epa.gov/risk/risk-based-screening-table-generic-tables

(2) Date shown for IRIS is the date IRIS was searched. http://www.epa.gov/iris/ Date shown for other sources is the publication date.

(3) TCE is considered carcinogenic by a mutagenic mode of action for induction of kidney tumors. The adult-based IUR for kidney cancer is 1×10^{-6} per $\mu g/m^3$.

(4) IUR listed is based on continuous lifetime exposure during adulthood. The IUR for the continuous lifetime exposure from birth is 8.8×10^{-6} per $\mu g/m^3$.

(5) based on chromium (VI)

(6) weight of evidence is based on nickel refinery dust

Definition:
Cal/EPA = California Environmental Protection Agency
IRIS = Integrated Risk Information System
M = mutagen
NA = not available
$\mu g/m^3$ = microgram per cubic meter
PPRTV = Provisional Peer Reviewed Toxicity Value

EPA Weight of Evidence (EPA 1986, EPA 1996):
A - Human Carcinogen
B1 - Probable human carcinogen indicates that limited human data are available
B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans
C - Possible human carcinogen
D - Not classifiable as human carcinogen

EPA Weight of Evidence Narrative (EPA 2005):
Carcinogenic to human
Likely to be carcinogenic to humans
Suggestive evidence of carcinogenic potential
Inadequate information to assess carcinogenic potential
Not likely to be carcinogenic to humans

TABLE 6-1
SUMMARY OF CANCER RISKS
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

Time Frame	Receptor	Cancer Risk [1]			
		RME	Risk Driver	CTE	Risk Driver
Current/Future	Resident - lifetime [2]	**1E-02**	1,1,2,2-Tetrachlroethane (5×10^{-6}) 1,1-DCA (2×10^{-5}) 1,2-DCA (3×10^{-6}) 1,4-DCB (3×10^{-5}) Benzene (3×10^{-6}) Bromodichloromethane (6×10^{-6}) Chloroform (3×10^{-5}) **TCE (5×10^{-4}) (5%)** **VC (4×10^{-3}) (37%)** 1,4-Dioxane (3×10^{-5}) Benzo(a)anthracene (1×10^{-5}) **Benzo(b)fluoranthene (1×10^{-4}) (1%)** bis(2-Ethylhexyl)Phthalate (3×10^{-6}) **Chromium (6×10^{-3}) (56%)**	**3E-03**	**TCE (1×10^{-4}) (5%)** **VC (7×10^{-4}) (30%)** 1,4-Dioxane (6×10^{-6}) Benzo(a)anthracene (9×10^{-6}) Benzo(b)fluoranthene (6×10^{-5}) **Chromium (2×10^{-3}) (62%)**

1,1-DCA = 1,1-dichloroethane
1,2-DCA = 1,2-dichloroethane
1,4-DCB = 1,4-Dichlorobenzene
cis-1,2-DCE = cis-1,2-Dichloroethene
RME = reasonable maximum exposure
CTE = central tendency exposure
TCE = trichloroethene
VC = vinyl chloride

Notes:
[1] Bolded values exceed EPA's target range of $1x10^{-6}$ to $1x10^{-4}$
[2] Cancer risk for residents is based on age-adjusted scenario combining child and adult exposures.

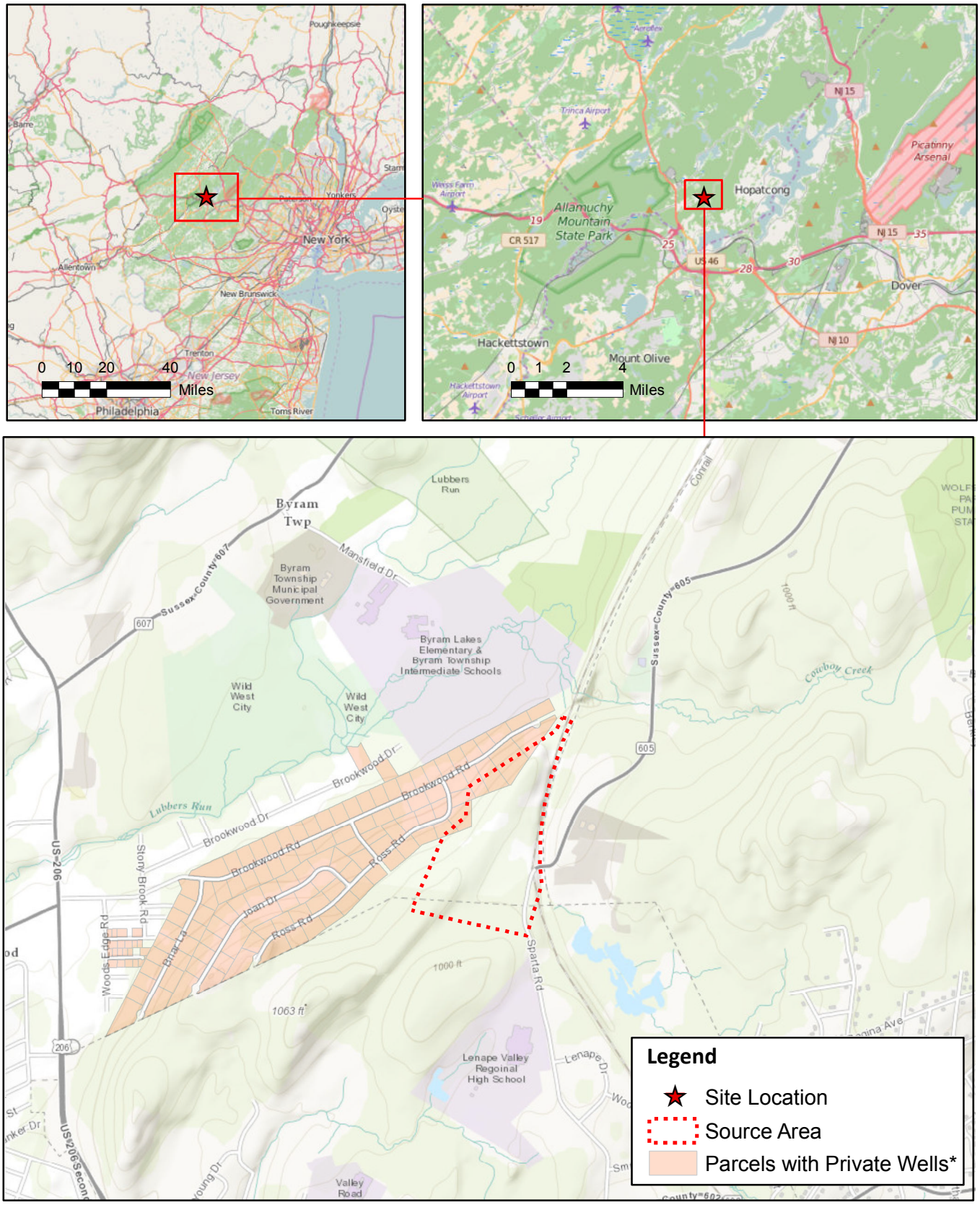
TABLE 6-2
SUMMARY OF NONCANCER HEALTH HAZARDS
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

Time Frame	Receptor	Noncancer Hazard Index [1]			
		RME	Organ/Effect (Risk Driver)	CTE	Organ/Effect (Risk Driver)
Current/Future	Resident - Adult [2]	**110**	HI Body and Organ Weight: 2 (Nickel) HI Development: 93 (TCE) HI Heart: 93 (TCE) HI Immune System: 93 (TCE) HI Kidney: 94 (cis-1,2-DCE, Chlorobenzene, TCE) HI Liver: 94 (1,2,3-Trichlorobenzene, Chlorobenzene, TCE, VC) HI Lung: 11 (Antimony, Chromium, Cobalt) HI Respiratory System: 3 (Cobalt, Nickel) HI Thyroid: 2 (1,2,3-Trichlorobenzene, Cobalt)	**18**	HI Development: 9 (TCE) HI Heart: 9 (TCE) HI Immune System: 9 (TCE) HI Kidney: 10 (cis-1,2-DCE, Chlorobenzene, TCE) HI Liver: 10 (1,2,3-Trichlorobenzene, Chlorobenzene, TCE, VC) HI Lung: 6 (Antimony, Chromium, Cobalt)
	Resident - Child (birth to <6 years)[3]	**106**	HI Body and Organ Weight: 3 (Nickel) HI Development: 79 (TCE) HI GI Tract: 2 (Iron) HI Heart: 79 (TCE) HI Immune System: 79 (TCE) HI Kidney: 81 (cis-1,2-DCE, Chlorobenzene, TCE) HI Liver: 81 (1,2,3-Trichlorobenzene, Chlorobenzene, TCE, VC, 2,3,4,6-Tetrachlorophenol) HI Lung: 18 (Antimony, Chromium, Cobalt) HI Respiratory System: 6 (Cobalt, Nickel) HI Thyroid: 3 (1,2,3-Trichlorobenzene, Cobalt)	**33**	HI Body and Organ Weight: 2 (Nickel) HI Development: 17 (TCE) HI Heart: 17 (TCE) HI Immune System: 17 (TCE) HI Kidney: 17 (cis-1,2-DCE, Chlorobenzene, TCE) HI Liver: 17 (1,2,3-Trichlorobenzene, Chlorobenzene, TCE, VC) HI Lung: 11 (Antimony, Chromium, Cobalt) HI Respiratory System: 3 (Cobalt, Nickel)

1,1-DCA = 1,1-dichloroethane
1,2-DCA = 1,2-dichloroethane
1,4-DCB = 1,4-Dichlorobenzene
cis-1,2-DCE = cis-1,2-Dichloroethene
RME = reasonable maximum exposure
CNS = central nervous system
CTE = central tendency exposure
GI = gastrointestinal
TCE = trichloroethene
VC = vinyl chloride

Notes:
[1] Bolded values exceed EPA's threshold of unity (1)
[2] For residents, noncancer hazard indices are based on adult and child exposures evaluated separately

Figures



Top two images adapted from EES JV Revised Data Evaluation Summary Report (DESR) (2016)

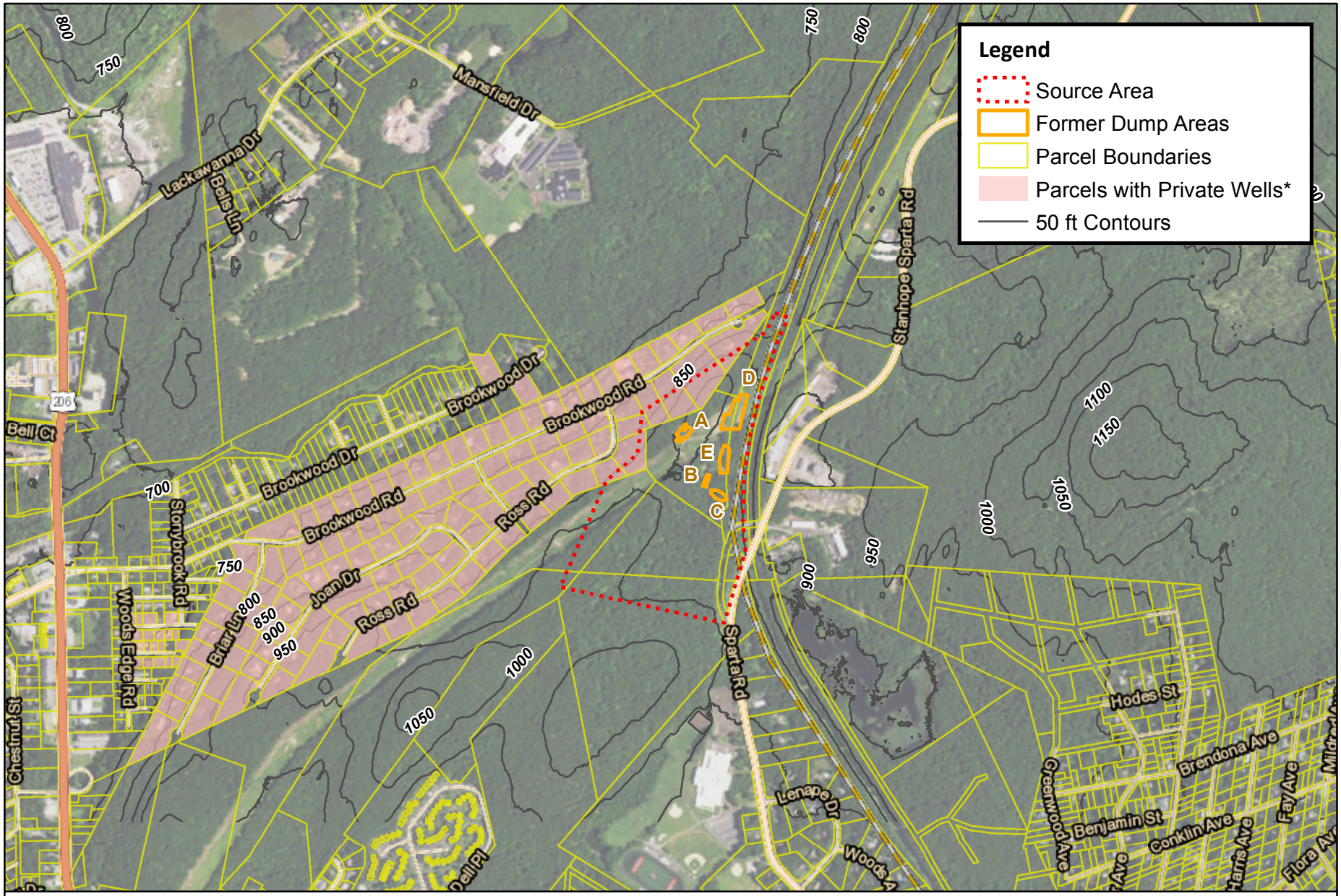
* As identified in the DESR. Only the residential community west of the source area was evaluated in the report.

N

0 0.25 0.5 1
Miles

CDM Smith

Figure 2-1
Site Location Map
Mansfield Trail Dump Site, OU1
Byram Township, NJ



* As identified in the EES JV Revised Data Evaluation Summary Report (2016). Only the residential community west of the source area was evaluated in the report.

N

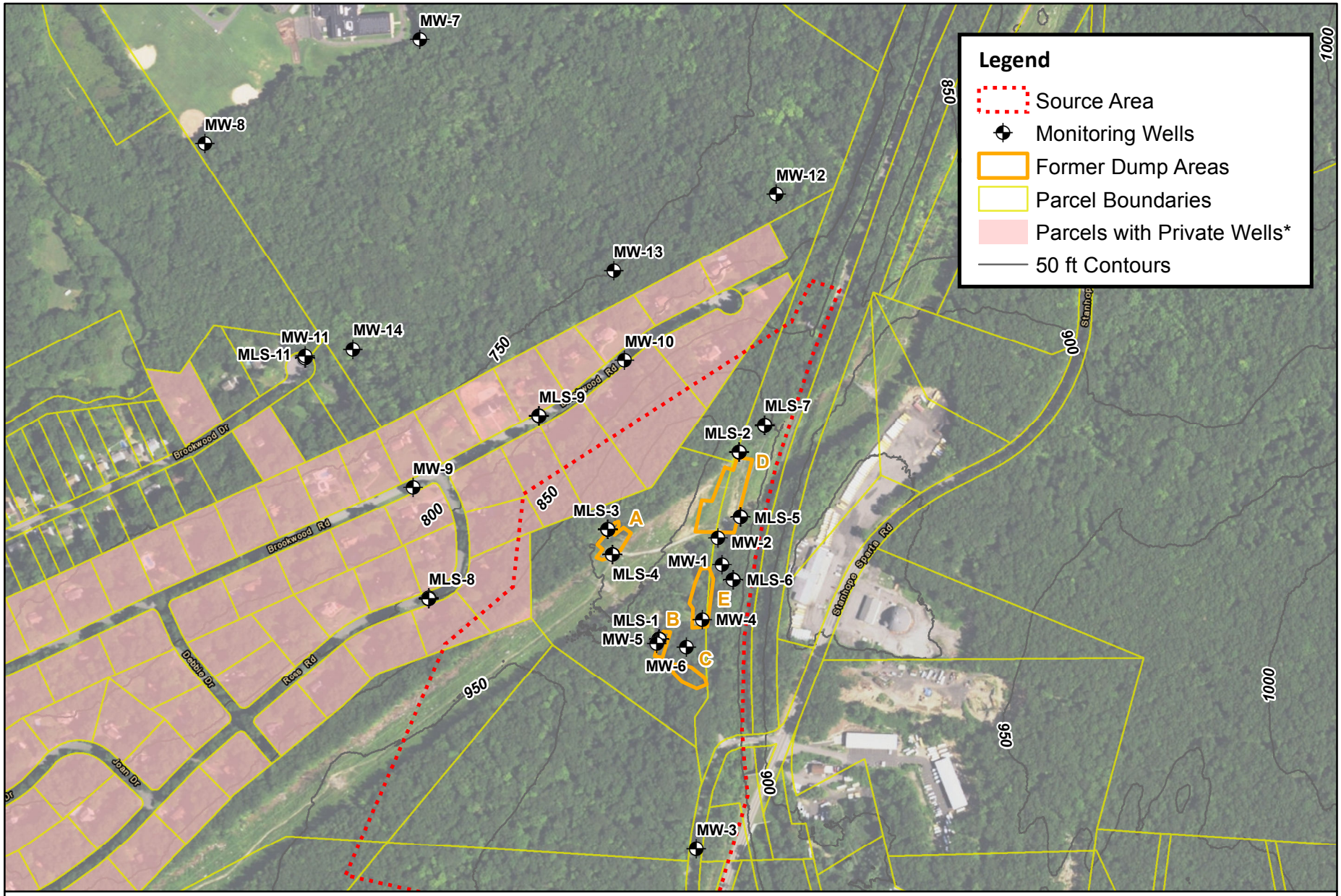
0 250 500 1,000

Feet

Figure 2-2
Site Map
Mansfield Trail Dump Site, OU1
Byram Township, NJ

CDM Smith

liuy2 \\Nynsvr1\IMS\GIS\Mansfield Trail Dump Site\MXD\Figure 2-2 Site Map_Risk_Assessment.mxd 12/5/2016



* As identified in the EES JV Revised Data Evaluation Summary Report (2016). Only the residential community west of the source area was evaluated in the report.

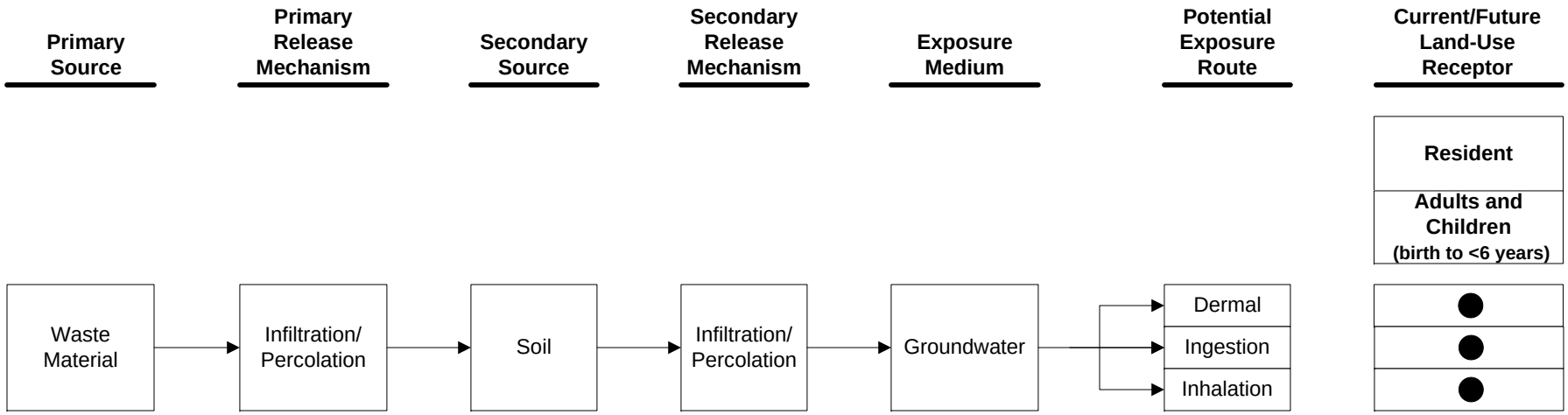
N

0 250 500 1,000 Feet

CDM Smith

Figure 3-1
Monitoring Well Locations
Mansfield Trail Dump Site, OU1
Byram Township, NJ

liuy2 \\Nynsvr1\IMS\GIS\Mansfield Trail Dump Site\MXD\Figure 3-1 Dump Areas and MW Risk_Assessment.mxd 12/5/2016



Legend:

● complete exposure pathway

CDM Smith

Figure 4-1
Conceptual Site Mode
Human Health Risk Assessment
Mansfield Trail Dump Site, Operable Unit 1
Byram Township, New Jersey

Appendix A

Appendix A

Table A-1 Available Well Data for Use in the Human Health Risk Assessment

Table A-1
Available Monitoring Well Data for Use in the Human Health Risk Assessment
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

Sampling Date	Location	Sample Identification	Start Depth	End Depth	Depth Unit	Analyte Group	Used in the Screening (Table B-2.1a) and EPC Development (Table B-3.1)?	Rationale	Notes:
4/8/2014	MLS-1-1	MLS-1-45-0414	30	45	ft	VOCs, SVOCs, Pesticides, Aroclors, Inorganics	No	Well located outside the core of the plume.	6 ports sampled twice
11/5/2014	MLS-1-1	MLS-1-45-1114	30	45	ft	VOCs, SVOCs-SIM, Inorganics	No	Well located outside the core of the plume.	
4/8/2014	MLS-1-2	MLS-1-95-0414	80	95	ft	VOCs, SVOCs, Pesticides, Aroclors, Inorganics	No	Well located outside the core of the plume.	
11/5/2014	MLS-1-2	MLS-1-95-1114	80	95	ft	VOCs, SVOCs-SIM, Inorganics	No	Well located outside the core of the plume.	
4/8/2014	MLS-1-3	MLS-1-122-0414	107	122	ft	VOCs, SVOCs, Pesticides, Aroclors, Inorganics	No	Well located outside the core of the plume.	
11/5/2014	MLS-1-3	MLS-1-122-1114	107	122	ft	VOCs, SVOCs-SIM, Inorganics	No	Well located outside the core of the plume.	
4/8/2014	MLS-1-4	MLS-1-244-0414	229	244	ft	VOCs, SVOCs, Pesticides, Aroclors, Inorganics	No	Well located outside the core of the plume.	
11/5/2014	MLS-1-4	MLS-1-244-1114	229	244	ft	VOCs, SVOCs-SIM, Inorganics	No	Well located outside the core of the plume.	
4/8/2014	MLS-1-5	MLS-1-300-0414	285	300	ft	VOCs, SVOCs, Pesticides, Aroclors, Inorganics	No	Well located outside the core of the plume.	
11/5/2014	MLS-1-5	MLS-1-300-1114	285	300	ft	VOCs, SVOCs-SIM, Inorganics	No	Well located outside the core of the plume.	
4/8/2014	MLS-1-6	MLS-1-357-0414	342	357	ft	VOCs, SVOCs, Pesticides, Aroclors, Inorganics	No	Well located outside the core of the plume.	
11/5/2014	MLS-1-6	MLS-1-357-1114	342	357	ft	VOCs, SVOCs-SIM, Inorganics	No	Well located outside the core of the plume.	
11/10/2014	MLS-2-2	MLS-2-70-1114	55	70	ft	VOCs, SVOCs, SVOCs-SIM, Pesticides, Aroclors, Inorganics	Yes	Well located within the core of the plume. Only using November 2014 data.	5 ports sampled once
11/10/2014	MLS-2-3	MLS-2-115-1114	100	115	ft	VOCs, SVOCs, SVOCs-SIM, Pesticides, Aroclors, Inorganics	Yes	Well located within the core of the plume. Only using November 2014 data.	
11/10/2014	MLS-2-4	MLS-2-134-1114	119	134	ft	VOCs, SVOCs, SVOCs-SIM, Pesticides, Aroclors, Inorganics	Yes	Well located within the core of the plume. Only using November 2014 data.	
11/10/2014	MLS-2-5	MLS-2-180-1114	165	180	ft	VOCs, SVOCs, SVOCs-SIM, Pesticides, Aroclors, Inorganics	Yes	Well located within the core of the plume. Only using November 2014 data.	
11/10/2014	MLS-2-6	MLS-2-355-1114	340	355	ft	VOCs, SVOCs, SVOCs-SIM, Pesticides, Aroclors, Inorganics	Yes	Well located within the core of the plume. Only using November 2014 data.	

Table A-1
Available Monitoring Well Data for Use in the Human Health Risk Assessment
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

Sampling Date	Location	Sample Identification	Start Depth	End Depth	Depth Unit	Analyte Group	Used in the Screening (Table B-2.1a) and EPC Development (Table B-3.1)?	Rationale	Notes:
4/7/2014	MLS-3-1	MLS-3-80-0414	65	80	ft	VOCs, SVOCs, Pesticides, Aroclors, Inorganics	No	Only using November 2014 data.	
11/14/2014	MLS-3-1	MLS-3-80-1114	65	80	ft	VOCs, SVOCs-SIM, Inorganics	Yes	Well located within the core of the plume. Only using November 2014 data.	
4/7/2014	MLS-3-2	MLS-3-125-0414	110	125	ft	VOCs, SVOCs, Pesticides, Aroclors, Inorganics	No	Only using November 2014 data.	7 ports sampled twice
11/14/2014	MLS-3-2	MLS-3-125-1114	110	125	ft	VOCs, SVOCs-SIM, Inorganics	yes	Well located within the core of the plume. Only using November 2014 data.	
4/8/2014	MLS-3-3	MLS-3-189-0414	174	189	ft	VOCs, SVOCs, Pesticides, Aroclors, Inorganics	No	Only using November 2014 data.	
11/14/2014	MLS-3-3	MLS-3-189-1114	174	189	ft	VOCs, SVOCs-SIM, Inorganics	Yes	Well located within the core of the plume. Only using November 2014 data.	
4/8/2014	MLS-3-4	MLS-3-230-0414	215	230	ft	VOCs, SVOCs, Pesticides, Aroclors, Inorganics	No	Only using November 2014 data.	
11/14/2014	MLS-3-4	MLS-3-230-1114	215	230	ft	VOCs, SVOCs-SIM, Inorganics	Yes	Well located within the core of the plume. Only using November 2014 data.	
4/8/2014	MLS-3-5	MLS-3-255-0414	240	255	ft	VOCs, SVOCs, Pesticides, Aroclors, Inorganics	No	Only using November 2014 data.	
11/14/2014	MLS-3-5	MLS-3-255-1114	240	255	ft	VOCs, SVOCs-SIM, Inorganics	Yes	Well located within the core of the plume. Only using November 2014 data.	7 ports sampled twice
4/8/2014	MLS-3-6	MLS-3-310-0414	295	310	ft	VOCs, SVOCs, Pesticides, Aroclors, Inorganics	No	Only using November 2014 data.	
11/14/2014	MLS-3-6	MLS-3-310-1114	295	310	ft	VOCs, SVOCs-SIM, Inorganics	Yes	Well located within the core of the plume. Only using November 2014 data.	
4/8/2014	MLS-3-7	MLS-3-340-0414	325	340	ft	VOCs, SVOCs, Pesticides, Aroclors, Inorganics	No	Only using November 2014 data.	
11/14/2014	MLS-3-7	MLS-3-340-1114	325	340	ft	VOCs, SVOCs-SIM, Inorganics	Yes	Well located within the core of the plume. Only using November 2014 data.	

Table A-1
Available Monitoring Well Data for Use in the Human Health Risk Assessment
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

Sampling Date	Location	Sample Identification	Start Depth	End Depth	Depth Unit	Analyte Group	Used in the Screening (Table B-2.1a) and EPC Development (Table B-3.1)?	Rationale	Notes:
11/11/2014	MLS-4-1	MLS-4-88-1114	73	88	ft	VOCs, SVOCs, SVOCs-SIM, Pesticides, Aroclors, Inorganics	Yes	Well located within the core of the plume. Only using November 2014 data.	6 ports sampled once
11/11/2014	MLS-4-2	MLS-4-125-1114	110	125	ft	VOCs, SVOCs, SVOCs-SIM, Pesticides, Aroclors, Inorganics	Yes	Well located within the core of the plume. Only using November 2014 data.	
11/11/2014	MLS-4-3	MLS-4-215-1114	200	215	ft	VOCs, SVOCs, SVOCs-SIM, Pesticides, Aroclors, Inorganics	Yes	Well located within the core of the plume. Only using November 2014 data.	
11/11/2014	MLS-4-4	MLS-4-325-1114	310	325	ft	VOCs, SVOCs, SVOCs-SIM, Pesticides, Aroclors, Inorganics	Yes	Well located within the core of the plume. Only using November 2014 data.	
11/11/2014	MLS-4-5	MLS-4-376-1114	361	376	ft	VOCs, SVOCs, SVOCs-SIM, Pesticides, Aroclors, Inorganics	Yes	Well located within the core of the plume. Only using November 2014 data.	
11/11/2014	MLS-4-6	MLS-4-475-1114	460	475	ft	VOCs, SVOCs, SVOCs-SIM, Pesticides, Aroclors, Inorganics	Yes	Well located within the core of the plume. Only using November 2014 data.	
11/13/2014	MLS-5-1	MLS-5-49-1114	34	49	ft	VOCs, SVOCs, SVOCs-SIM, Pesticides, Aroclors, Inorganics	Yes	Well located within the core of the plume. Only using November 2014 data.	5 ports sampled once
11/13/2014	MLS-5-2	MLS-5-90-1114	75	90	ft	VOCs, SVOCs, SVOCs-SIM, Pesticides, Aroclors, Inorganics	Yes	Well located within the core of the plume. Only using November 2014 data.	
11/13/2014	MLS-5-3	MLS-5-117-1114	102	117	ft	VOCs, SVOCs, SVOCs-SIM, Pesticides, Aroclors, Inorganics	Yes	Well located within the core of the plume. Only using November 2014 data.	
11/13/2014	MLS-5-4	MLS-5-209-1114	194	209	ft	VOCs, SVOCs, SVOCs-SIM, Pesticides, Aroclors, Inorganics	Yes	Well located within the core of the plume. Only using November 2014 data.	
11/13/2014	MLS-5-5	MLS-5-328-1114	313	328	ft	VOCs, SVOCs, SVOCs-SIM, Pesticides, Aroclors, Inorganics	Yes	Well located within the core of the plume. Only using November 2014 data.	
11/6/2014	MLS-6-1	MLS-6-45-1114	30	45	ft	VOCs, SVOCs, SVOCs-SIM, Pesticides, Aroclors, Inorganics	Yes	Well located within the core of the plume. Only using November 2014 data.	7 ports sampled once
11/6/2014	MLS-6-2	MLS-6-65-1114	50	65	ft	VOCs, SVOCs, SVOCs-SIM, Pesticides, Aroclors, Inorganics	Yes	Well located within the core of the plume. Only using November 2014 data.	
11/6/2014	MLS-6-3	MLS-6-125-1114	110	125	ft	VOCs, SVOCs, SVOCs-SIM, Pesticides, Aroclors, Inorganics	Yes	Well located within the core of the plume. Only using November 2014 data.	7 ports sampled once
11/7/2014	MLS-6-4	MLS-6-175-1114	160	175	ft	VOCs, SVOCs, SVOCs-SIM, Pesticides, Aroclors, Inorganics	Yes	Well located within the core of the plume. Only using November 2014 data.	
11/7/2014	MLS-6-5	MLS-6-215-1114	200	215	ft	VOCs, SVOCs, SVOCs-SIM, Pesticides, Aroclors, Inorganics	Yes	Well located within the core of the plume. Only using November 2014 data.	
11/7/2014	MLS-6-6	MLS-6-250-1114	235	250	ft	VOCs, SVOCs, SVOCs-SIM, Pesticides, Aroclors, Inorganics	Yes	Well located within the core of the plume. Only using November 2014 data.	
11/7/2014	MLS-6-7	MLS-6-336-1114	321	336	ft	VOCs, SVOCs, SVOCs-SIM, Pesticides, Aroclors, Inorganics	Yes	Well located within the core of the plume. Only using November 2014 data.	

Table A-1
Available Monitoring Well Data for Use in the Human Health Risk Assessment
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

Sampling Date	Location	Sample Identification	Start Depth	End Depth	Depth Unit	Analyte Group	Used in the Screening (Table B-2.1a) and EPC Development (Table B-3.1)?	Rationale	Notes:
11/10/2014	MLS-7-1	MLS-7-50-1114	35	50	ft	VOCs, SVOCs, SVOCs-SIM, Pesticides, Aroclors, Inorganics	Yes	Well located within the core of the plume. Only using November 2014 data.	5 ports sampled once
11/10/2014	MLS-7-2	MLS-7-82-1114	67	82	ft	VOCs, SVOCs, SVOCs-SIM, Pesticides, Aroclors, Inorganics	Yes	Well located within the core of the plume. Only using November 2014 data.	
11/10/2014	MLS-7-3	MLS-7-134-1114	119	134	ft	VOCs, SVOCs, SVOCs-SIM, Pesticides, Aroclors, Inorganics	Yes	Well located within the core of the plume. Only using November 2014 data.	
11/10/2014	MLS-7-4	MLS-7-285-1114	270	285	ft	VOCs, SVOCs, SVOCs-SIM, Pesticides, Aroclors, Inorganics	Yes	Well located within the core of the plume. Only using November 2014 data.	
11/10/2014	MLS-7-5	MLS-7-391-1114	376	391	ft	VOCs, SVOCs, SVOCs-SIM, Pesticides, Aroclors, Inorganics	Yes	Well located within the core of the plume. Only using November 2014 data.	
11/13/2014	MLS-8-1	MLS-8-70-1114	55	70	ft	VOCs, SVOCs, SVOCs-SIM, Pesticides, Aroclors, Inorganics	Yes	Well located within the core of the plume. Only using November 2014 data.	6 ports sampled once
11/13/2014	MLS-8-2	MLS-8-85-1114	70	85	ft	VOCs, SVOCs, SVOCs-SIM, Pesticides, Aroclors, Inorganics	Yes	Well located within the core of the plume. Only using November 2014 data.	
11/13/2014	MLS-8-3	MLS-8-123-1114	108	123	ft	VOCs, SVOCs, SVOCs-SIM, Pesticides, Aroclors, Inorganics	Yes	Well located within the core of the plume. Only using November 2014 data.	
11/13/2014	MLS-8-4	MLS-8-220-1114	205	220	ft	VOCs, SVOCs, SVOCs-SIM, Pesticides, Aroclors, Inorganics	Yes	Well located within the core of the plume. Only using November 2014 data.	
11/13/2014	MLS-8-5	MLS-8-250-1114	235	250	ft	VOCs, SVOCs, SVOCs-SIM, Pesticides, Aroclors, Inorganics	Yes	Well located within the core of the plume. Only using November 2014 data.	
11/13/2014	MLS-8-6	MLS-8-296-1114	281	296	ft	VOCs, SVOCs, SVOCs-SIM, Pesticides, Aroclors, Inorganics	Yes	Well located within the core of the plume. Only using November 2014 data.	
11/12/2014	MLS-9-1	MLS-9-69-1114	54	69	ft	VOCs, SVOCs, SVOCs-SIM, Pesticides, Aroclors, Inorganics	Yes	Well located within the core of the plume. Only using November 2014 data.	
11/12/2014	MLS-9-2	MLS-9-97-1114	82	97	ft	VOCs, SVOCs, SVOCs-SIM, Pesticides, Aroclors, Inorganics	Yes	Well located within the core of the plume. Only using November 2014 data.	
11/12/2014	MLS-9-3	MLS-9-115-1114	100	115	ft	VOCs, SVOCs, SVOCs-SIM, Pesticides, Aroclors, Inorganics	Yes	Well located within the core of the plume. Only using November 2014 data.	
11/12/2014	MLS-9-4	MLS-9-140-1114	125	140	ft	VOCs, SVOCs, SVOCs-SIM, Pesticides, Aroclors, Inorganics	Yes	Well located within the core of the plume. Only using November 2014 data.	
11/12/2014	MLS-9-5	MLS-9-190-1114	175	190	ft	VOCs, SVOCs, SVOCs-SIM, Pesticides, Aroclors, Inorganics	Yes	Well located within the core of the plume. Only using November 2014 data.	
11/12/2014	MLS-9-6	MLS-9-286-1114	271	286	ft	VOCs, SVOCs, SVOCs-SIM, Pesticides, Aroclors, Inorganics	Yes	Well located within the core of the plume. Only using November 2014 data.	

Table A-1
Available Monitoring Well Data for Use in the Human Health Risk Assessment
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

Sampling Date	Location	Sample Identification	Start Depth	End Depth	Depth Unit	Analyte Group	Used in the Screening (Table B-2.1a) and EPC Development (Table B-3.1)?	Rationale	Notes:
11/12/2014	MLS-11-1	MLS-11-74-1114	59	74	ft	VOCs, SVOCs, SVOCs-SIM, Pesticides, Aroclors, Inorganics	No	Well located outside the core of the plume.	6 ports sampled once
11/12/2014	MLS-11-2	MLS-11-115-1114	100	115	ft	VOCs, SVOCs, SVOCs-SIM, Pesticides, Aroclors, Inorganics	No	Well located outside the core of the plume.	
11/12/2014	MLS-11-3	MLS-11-190-1114	175	190	ft	VOCs, SVOCs, SVOCs-SIM, Pesticides, Aroclors, Inorganics	No	Well located outside the core of the plume.	
11/12/2014	MLS-11-4	MLS-11-215-1114	200	215	ft	VOCs, SVOCs, SVOCs-SIM, Pesticides, Aroclors, Inorganics	No	Well located outside the core of the plume.	
11/12/2014	MLS-11-5	MLS-11-292-1114	277	292	ft	VOCs, SVOCs, SVOCs-SIM, Pesticides, Aroclors, Inorganics	No	Well located outside the core of the plume.	
11/12/2014	MLS-11-6	MLS-11-367-1114	352	367	ft	VOCs, SVOCs, SVOCs-SIM, Pesticides, Aroclors, Inorganics	No	Well located outside the core of the plume.	
5/6/2010	MW1	BYR-GW109	90	100	ft		No	Only using November 2014 data.	
4/8/2014	MW1	MW-1-15-0414	15	15	ft	VOCs, SVOCs, Pesticides, Aroclors, Inorganics	No	Only using November 2014 data.	Sampled at three discreet depth intervals
11/4/2014	MW1	MW-1-35-1114	35	35	ft	VOCs, SVOCs-SIM, Inorganics	Yes	Well located within the core of the plume. Only using November 2014 data.	
4/8/2014	MW1	MW-1-60-0414	60	60	ft	VOCs, SVOCs, Pesticides, Aroclors, Inorganics	No	Only using November 2014 data.	
11/4/2014	MW1	MW-1-60-1114	60	60	ft	VOCs, SVOCs-SIM, Inorganics	Yes	Well located within the core of the plume. Only using November 2014 data.	
4/6/2014	MW1	MW-1-98-0414	98	98	ft	VOCs, SVOCs, Pesticides, Aroclors, Inorganics	No	Only using November 2014 data.	
11/3/2014	MW1	MW-1-98-1114	98	98	ft	VOCs, SVOCs-SIM, Inorganics	Yes	Well located within the core of the plume. Only using November 2014 data.	

Table A-1
Available Monitoring Well Data for Use in the Human Health Risk Assessment
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

Sampling Date	Location	Sample Identification	Start Depth	End Depth	Depth Unit	Analyte Group	Used in the Screening (Table B-2.1a) and EPC Development (Table B-3.1)?	Rationale	Notes:
5/7/2010	MW2	BYR-GW110	90	100	ft		No	Only using November 2014 data.	
4/7/2014	MW2	MW-2-19-0414	19	19	ft	VOCs, SVOCs, Pesticides, Aroclors, Inorganics	No	Only using November 2014 data.	Sampled at three discreet depth intervals
11/4/2014	MW2	MW-2-36-1114	36	36	ft	VOCs, SVOCs-SIM, Inorganics	Yes	Well located within the core of the plume. Only using November 2014 data.	
4/7/2014	MW2	MW-2-60-0414	60	60	ft	VOCs, SVOCs, Pesticides, Aroclors, Inorganics	No	Only using November 2014 data.	
11/4/2014	MW2	MW-2-60-1114	60	60	ft	VOCs, SVOCs-SIM, Inorganics	Yes	Well located within the core of the plume. Only using November 2014 data.	
4/6/2014	MW2	MW-2-98-0414	98	98	ft	VOCs, SVOCs, Pesticides, Aroclors, Inorganics	No	Only using November 2014 data.	
11/3/2014	MW2	MW-2-98-1114	98	98	ft	VOCs, SVOCs-SIM, Inorganics	Yes	Well located within the core of the plume. Only using November 2014 data.	
4/8/2014	MW3	MW-3-7.5-0414	7.5	7.5	ft	VOCs, SVOCs, Pesticides, Aroclors, Inorganics	No	Well located outside the core of the plume.	
11/5/2014	MW3	MW-3-22-1114	22	22	ft	VOCs, SVOCs-SIM, Inorganics	No	Well located outside the core of the plume.	
4/8/2014	MW3	MW-3-60-0414	60	60	ft	VOCs, SVOCs, Pesticides, Aroclors, Inorganics	No	Well located outside the core of the plume.	
11/5/2014	MW3	MW-3-60-1114	60	60	ft	VOCs, SVOCs-SIM, Inorganics	No	Well located outside the core of the plume.	
4/6/2014	MW3	MW-3-98-0414	98	98	ft	VOCs, SVOCs, Pesticides, Aroclors, Inorganics	No	Well located outside the core of the plume.	
11/4/2014	MW3	MW-3-98-1114	98	98	ft	VOCs, SVOCs-SIM, Inorganics	No	Well located outside the core of the plume.	
4/3/2014	MW-4	MW-4-0414	10	20	ft	VOCs, SVOCs, Pesticides, Aroclors, Inorganics	No	Well located outside the core of the plume.	
11/14/2014	MW-4	MW-4-1114	10	20	ft	VOCs, SVOCs-SIM, Inorganics	No	Well located outside the core of the plume.	
4/5/2014	MW-5	MW-5-0414	5	10	ft	VOCs, SVOCs, Pesticides, Aroclors, Inorganics	No	Well located outside the core of the plume.	
4/4/2014	MW-6	MW-6-0414	10	20	ft	VOCs, SVOCs, Pesticides, Aroclors, Inorganics	No	Well located outside the core of the plume.	
11/5/2014	MW-6	MW-6-1114	10	20	ft	VOCs, SVOCs-SIM, Inorganics	No	Well located outside the core of the plume.	

Table A-1
Available Monitoring Well Data for Use in the Human Health Risk Assessment
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

Sampling Date	Location	Sample Identification	Start Depth	End Depth	Depth Unit	Analyte Group	Used in the Screening (Table B-2.1a) and EPC Development (Table B-3.1)?	Rationale	Notes:
2/29/2016	MW-7	MW-7-0216	3	13	ft	SVOCs, Inorganics	No	Well located outside the core of the plume.	
2/29/2016	MW-8	MW-8-0216	4.8000002	14.8	ft	SVOCs, Inorganics	No	Well located outside the core of the plume.	
11/10/2015	MW-9	MW-9-1115	40	50	ft	VOCs, SVOCs-SIM, Inorganics	No	Well located outside the core of the plume.	
11/11/2015	MW-10	MW-10-1115	13	23	ft	VOCs, Inorganics	No	Well located outside the core of the plume.	
11/10/2015	MW-11	MW-11-1115	29	39	ft	VOCs, SVOCs-SIM, Inorganics	No	Well located outside the core of the plume.	
11/11/2015	MW-12	MW-12-1115	5	15	ft	VOCs, SVOCs-SIM, Inorganics	No	Well located outside the core of the plume.	
11/11/2015	MW-13	MW-13-1115	8.5	18.5	ft	VOCs, SVOCs-SIM, Inorganics	No	Well located outside the core of the plume.	
11/12/2015	MW-14	MW-14-1115	4	14	ft	VOCs, SVOCs-SIM, Inorganics	No	Well located outside the core of the plume.	

Note:
1. Total (unfiltered) inorganics evaluated in the human health risk assessment.

ft = foot
VOC = volatile organic compound
SVOC = semi-volatile organic compound
SIM = selected ion monitoring

Appendix B

Appendix B

RAGS D Tables – Reasonable Maximum Exposure Scenario

Appendix B Contents
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

[(1)] Noncancer hazards presented for the child receptor (birth to <6 years); cancer risks presented for the lifetime receptor.
[(2)] Noncancer hazards presented for the adult receptor; cancer risks presented for the lifetime receptor.

Table B-1
Selection of Exposure Pathways
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor (Age)	Exposure Route	Type of Analysis [1]	Rationale for Selection or Exclusion of Exposure Pathway
Current/Future	Groundwater	Groundwater	Tap Water	Resident	Adult and Child (birth to <6 years)	Ingestion	Quant	Residents are currently using groundwater pumped from their domestic wells for all their household needs and may continue to use the groundwater from these wells in the future in the absence of any remediation.
						Dermal	Quant	
						Inhalation	Quant	

Note:
[1] Quant = Quantitative risk analysis performed.

TABLE B-2.1a
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

Scenario Timeframe:	Current/Future
Medium:	Groundwater
Exposure Medium:	Groundwater

Exposure Point	CAS No.	Chemical	Minimum Concentration (Qualifier)		Maximum Concentration (Qualifier)		Unit	Location of Maximum Concentration[1]	Detection Frequency	Range of Reporting Limit	Concentration Used for Screening[2]	Background Value[3]	Screening Toxicity Value (n/c)[4]	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Yes/No)	Rationale for Selection or Deletion[5]
	71-55-6	1,1,1-Trichloroethane	0.23	J	29		µg/L	MLS-3-80	9 / 10	0.5 / 20	29	NA	800 n	200	DWR	No	BSL
	79-34-5	**1,1,2,2-Tetrachloroethane**	**0.24**	**J**	**0.24**	**J**	**µg/L**	**MLS-7-82**	**1 / 10**	**0.5 / 0.5**	**0.24**	**NA**	**0.076 c**	**NL**	**DWR**	**Yes**	**ASL**
	75-34-3	**1,1-Dichloroethane**	**0.14**	**J**	**35**		**µg/L**	**MW-1-60**	**10 / 10**	**0.5 / 0.5**	**35**	**NA**	**2.8 c**	**NL**	**DWR**	**Yes**	**ASL**
	75-35-4	1,1-Dichloroethene	0.46	J	3.1		µg/L	MW-1-60	7 / 10	0.5 / 0.5	3.1	NA	28 n	7	DWR	No	BSL
	87-61-6	**1,2,3-Trichlorobenzene**	**2**	**JN**	**24**	**JN**	**µg/L**	**MLS-2-180**	**4 / 10**	**0.5 / 0.5**	**24**	**NA**	**0.7 n**	**NL**	**DWR**	**Yes**	**ASL**
	120-82-1	1,2,4-Trichlorobenzene	0.25	J	0.25	J	µg/L	MW-1-98	1 / 10	0.5 / 0.5	0.25	NA	0.4 n	70	DWR	No	BSL
	95-50-1	1,2-Dichlorobenzene	0.26	J	16		µg/L	MW-1-60, MW-1-98	5 / 10	0.5 / 0.5	16	NA	30 n	600	DWR	No	BSL
	107-06-2	**1,2-Dichloroethane**	**0.1**	**J**	**0.34**	**J**	**µg/L**	**MW-1-60**	**4 / 10**	**0.5 / 0.5**	**0.34**	**NA**	**0.17 c**	**5**	**DWR**	**Yes**	**ASL**
	541-73-1	1,3-Dichlorobenzene	0.11	J	1.5		µg/L	MW-1-60, MW-1-98	4 / 10	0.5 / 0.5	1.5	NA	NA	NL	DWR	No	NTX
	106-46-7	**1,4-Dichlorobenzene**	**0.21**	**J**	**13**		**µg/L**	**MW-1-60, MW-1-98**	**5 / 10**	**0.5 / 0.5**	**13**	**NA**	**0.48 c**	**75**	**DWR**	**Yes**	**ASL**
	78-93-3	2-Butanone	2.9	J	77		µg/L	MLS-4-376	4 / 10	5 / 5	77	NA	560 n	NL	DWR	No	BSL
	67-64-1	Acetone	4.2	J	190		µg/L	MLS-3-189	8 / 10	5 / 14	190	NA	1400 n	NL	DWR	No	BSL
	71-43-2	**Benzene**	**0.16**	**J**	**1.6**		**µg/L**	**MW-1-60, MW-1-98**	**7 / 10**	**0.5 / 0.5**	**1.6**	**NA**	**0.46 c**	**5**	**DWR**	**Yes**	**TOX**
	74-97-5	Bromochloromethane	0.15	J	0.15	J	µg/L	MLS-2-180	1 / 10	0.5 / 0.5	0.15	NA	8.3 n	NL	DWR	No	BSL
	75-27-4	**Bromodichloromethane**	**0.1**	**J**	**0.71**		**µg/L**	**MLS-2-180**	**7 / 10**	**0.5 / 0.5**	**0.71**	**NA**	**0.13 c**	**80**	**DWR[14]**	**Yes**	**ASL**
	75-15-0	Carbon Disulfide	0.16	J	0.2	J	µg/L	MLS-2-180	3 / 10	0.5 / 0.5	0.2	NA	81 n	NL	DWR	No	BSL
	108-90-7	**Chlorobenzene**	**3.2**		**70**		**µg/L**	**MW-1-60**	**5 / 10**	**0.5 / 0.5**	**70**	**NA**	**7.8 n**	**100**	**DWR**	**Yes**	**ASL**
	75-00-3	Chloroethane	0.43	J	1.2		µg/L	MLS-2-70	2 / 10	0.5 / 0.5	1.2	NA	2100 n	NL	DWR	No	BSL
	67-66-3	**Chloroform**	**0.56**		**7.4**		**µg/L**	**MLS-2-180**	**7 / 10**	**0.5 / 0.5**	**7.4**	**NA**	**0.22 c**	**80**	**DWR[14]**	**Yes**	**ASL**
	74-87-3	Chloromethane	0.11	J	0.19	J	µg/L	MLS-3-340	3 / 10	0.5 / 0.5	0.19	NA	19 n	NL	DWR	No	BSL
	156-59-2	**cis-1,2-Dichloroethene**	**1.7**		**90**		**µg/L**	**MLS-6-65**	**10 / 10**	**0.5 / 0.5**	**90**	**NA**	**3.6 n**	**70**	**DWR**	**Yes**	**ASL**
	110-82-7	Cyclohexane	0.28	J	0.28	J	µg/L	MW-1-98	1 / 10	0.5 / 0.5	0.28	NA	1300 n	NL	DWR	No	BSL
	98-82-8	Isopropylbenzene	1.3		6		µg/L	MW-1-98	2 / 10	0.5 / 0.5	6	NA	45 n	NL	DWR	No	BSL
	108-87-2	Methylcyclohexane	1.3		1.3		µg/L	MW-1-60	1 / 10	0.5 / 0.5	1.3	NA	NA	NL	DWR	No	NTX
	75-09-2	Methylene Chloride	0.44	J	1		µg/L	MLS-2-180	2 / 10	0.5 / 0.5	1	NA	11 n	5	DWR	No	BSL
	95-47-6	o-Xylene	5.2		5.2		µg/L	MLS-6-65	1 / 10	0.5 / 0.5	5.2	ND	19 n	10000	DWR	No	BSL
	127-18-4	Tetrachloroethene	0.14	J	1.1		µg/L	MLS-3-310	5 / 10	0.5 / 0.5	1.1	0.22	4.1 n	5	DWR	No	BSL
	108-88-3	Toluene	5.4		110		µg/L	MLS-4-376	8 / 10	0.5 / 13	110	NA	110 n	1000	DWR	No	BSL
	156-60-5	trans-1,2-Dichloroethene	0.25	J	0.6		µg/L	MW-1-98	7 / 10	0.5 / 0.5	0.6	NA	36 n	100	DWR	No	BSL
	79-01-6	**Trichloroethene**	**3.8**		**270**		**µg/L**	**MLS-3-80**	**10 / 10**	**0.5 / 0.5**	**270**	**NA**	**0.28 n**	**5**	**DWR**	**Yes**	**TOX**
	75-01-4	**Vinyl Chloride**	**0.18**	**J**	**50**		**µg/L**	**MLS-6-65**	**6 / 10**	**0.5 / 0.5**	**50**	**NA**	**0.019 c**	**2**	**DWR**	**Yes**	**TOX**
	123-91-1	**1,4-Dioxane**	**0.15**	**J**	**26**		**µg/L**	**MLS-3-189**	**9 / 10**	**0.5 / 0.5**	**26**	**NA**	**0.46 c**	**NL**	**DWR**	**Yes**	**ASL**
	58-90-2	**2,3,4,6-Tetrachlorophenol**	**22**	**JN**	**110**	**JN**	**µg/L**	**MLS-5-117**	**2 / 7**	**5 / 5**	**110**		**24 n**	**NL**	**DWR**	**Yes**	**ASL**
	91-57-6	2-Methylnaphthalene	0.043	J	0.15		µg/L	MLS-5-49	3 / 7	0.1 / 5	0.15	NA	3.6 n	NL	DWR	No	BSL
	83-32-9	Acenaphthene	0.038	J	0.071	J	µg/L	MLS-5-90	2 / 7	0.1 / 5	0.071	NA	53 n	NL	DWR	No	BSL
	208-96-8	Acenaphthylene	0.24	J	0.24	J	µg/L	MLS-2-70	1 / 7	0.1 / 5	0.24	NA	53 n[6]	NL	DWR	No	BSL
	56-55-3	**Benzo(a)anthracene**	**0.035**	**J**	**0.035**	**J**	**µg/L**	**MLS-7-82**	**1 / 7**	**0.5 / 0.5**	**0.035**	**NA**	**0.012 c**	**NL**	**DWR**	**Yes**	**ASL**
	205-99-2	**Benzo(b)fluoranthene**	**0.15**	**J**	**0.15**	**J**	**µg/L**	**MLS-6-215**	**1 / 7**	**0.1 / 0.1**	**0.15**	**NA**	**0.034 c**	**NL**	**DWR**	**Yes**	**ASL**
	117-81-7	**Bis(2-Ethylhexyl)Phthalate**	**1.7**	**J**	**12**		**µg/L**	**MLS-4-88**	**4 / 7**	**5 / 5**	**12**	**ND**	**5.6 c**	**6**	**DWR**	**Yes**	**ASL**

TABLE B-2.1a
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

Scenario Timeframe:	Current/Future
Medium:	Groundwater
Exposure Medium:	Groundwater

Exposure Point	CAS No.	Chemical	Minimum Concentration (Qualifier)		Maximum Concentration (Qualifier)		Unit	Location of Maximum Concentration[1]	Detection Frequency	Range of Reporting Limit	Concentration Used for Screening [2]	Background Value [3]	Screening Toxicity Value (n/c) [4]	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Yes/No)	Rationale for Selection or Deletion [5]
Groundwater	218-01-9	Chrysene	0.015	J	0.015	J	µg/L	MLS-7-82	1 / 7	0.1 / 5	0.015	NA	3.4 c	NL	DWR	No	BSL
	84-66-2	Diethylphthalate	5.8		5.8		µg/L	MLS-6-45	1 / 7	5 / 5	5.8	NA	1500 n	NL	DWR	No	BSL
	91-20-3	**Naphthalene**	**0.03**	**J**	**0.26**		**µg/L**	**MLS-5-49**	**5 / 7**	**0.1 / 0.1**	**0.26**	**NA**	**0.17 c**	**NL**	**DWR**	**Yes**	**ASL**
	85-01-8	Phenanthrene	0.031	J	0.078	J	µg/L	MLS-5-209	3 / 7	0.1 / 5	0.078	NA	12 n[7]	NL	DWR	No	BSL
	7429-90-5	Aluminum	9.7	J	319		µg/L	MW-2-98	10 / 10	20 / 40	319	NA	2000 n	NL	DWR	No	BSL
	7440-36-0	**Antimony**	2.3		5.2		**µg/L**	MLS-4-376	**3 / 10**	2 / 2	**5.2**	**NA**	**0.78 n**	**6**	**DWR**	**Yes**	**ASL**
	7440-39-3	Barium	23.3		242		µg/L	MLS-3-340	10 / 10	1 / 35	242	NA	380 n	2000	DWR	No	BSL
	7440-41-7	Beryllium	0.043	J	0.055	J	µg/L	MLS-7-50	4 / 10	1 / 2	0.055	NA	2.5 n	4	DWR	No	BSL
	7440-43-9	Cadmium	0.066	J	0.14	J	µg/L	MLS-4-125	7 / 10	1 / 1	0.14	NA	0.92 n[8]	5	DWR	No	BSL
	7440-70-2	Calcium	21700		63700		µg/L	MLS-9-69	10 / 10	250 / 2500	63700	NA	NA	NL	DWR	No	NUT
	7440-47-3	**Chromium**	0.48	J	622		**µg/L**	MLS-3-125	**10 / 10**	1 / 4	**622**	**NA**	**0.035 c[9]**	**NL**	**DWR**	**Yes**	**ASL**
	7440-48-4	**Cobalt**	1.2		19.5		**µg/L**	MLS-3-125	**5 / 10**	1 / 1	**19.5**	**NA**	**0.6 n**	**NL**	**DWR**	**Yes**	**ASL**
	7440-50-8	Copper	1.2	J	30.8		µg/L	MLS-3-125	10 / 10	1 / 4	30.8	NA	80 n	1300	DWR[15]	No	BSL
	7439-89-6	**Iron**	173		30100		**µg/L**	MW-1-98	**10 / 10**	20 / 400	**30100**	**NA**	**1400 n**	**NL**	**DWR**	**Yes**	**ASL**
	7439-92-1	**Lead**	4.9		22.8		**µg/L**	MLS-7-50	**8 / 10**	1 / 1	**22.8**	**NA**	15	15	**DWR[15]**	**Yes**	**ASL**
	7439-95-4	Magnesium	3630		25100		µg/L	MLS-6-175	10 / 10	250 / 1000	25100	NA	NA	NL	DWR	No	NUT
	7439-96-5	**Manganese**	54.2		4370		**µg/L**	MW-1-35	**10 / 10**	1 / 25	**4370**	**NA**	**43 n[10]**	**NL**	**DWR**	**Yes**	**ASL**
	7440-02-0	**Nickel**	1.1		1260		**µg/L**	MLS-3-125	**9 / 10**	1 / 1	**1260**	**NA**	**39 n[11]**	**NL**	**DWR**	**Yes**	**ASL**
	7440-09-7	Potassium	756		2170		µg/L	MW-1-98	9 / 10	250 / 1000	2170	NA	NA	NL	DWR	No	NUT
	7782-49-2	Selenium	0.18	J	0.19	J	µg/L	MW-1-60	2 / 10	2 / 10	0.19	NA	10 n	50	DWR	No	BSL
	7440-23-5	Sodium	4250		33200		µg/L	MLS-8-70	10 / 10	250 / 2500	33200	NA	NA	NL	DWR	No	NUT
	7440-28-0	**Thallium**	0.037	J	0.063	J	**µg/L**	MLS-7-82	**2 / 10**	1 / 1	**0.063**	**NA**	**0.02 n[12]**	**2**	**DWR**	**Yes**	**ASL**
	7440-62-2	Vanadium	0.088	J	0.45	J	µg/L	MLS-3-125	4 / 10	1 / 10	0.45	NA	8.6 n[13]	NL	DWR	No	BSL
	7440-66-6	Zinc	3.8		157	J	µg/L	MLS-9-69	10 / 10	2 / 255	157	NA	600 n	NL	DWR	No	BSL

[1] Location includes sample depth. All samples collected in November 2014.

[2] Maximum detected concentration used for screening.

[3] There is no background value available for groundwater.

[4] Screened against Regional Screening Levels, May 2016, for tap water, adjusted to a cancer risk of 1×10^{-6} and hazard quotient of 0.1. http://www.epa.gov/risk/risk-based-screening-table-generic-tables

[5] Rationale Codes:

Selection Reason: ASL = above screening level
TOX = Group A carcinogen
Deletion Reason: BSL = below screening level
NUT = essential nutrient

[6] screening value for acenaphthene

[7] screening value for pyrene

[8] screening value for cadmium (water)

[9] screening value for chromium VI

[10] screening value for manganese (non-diet)

[11] screening value for nickel soluble salts

[12] screening value for thallium soluble salts

[13] screening value for vanadium and compounds

[14] total trihalomethanes

[15] action level

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered
c = screening toxicity value based on cancer effects
COPC = chemical of potential concern
DWR = National Primary Drinking Water Regulation
J = qualifier for estimated value
n = screening toxicity value based on noncancer effects
NA = not available
ND = not detected
JN = qualifier for tentatively identified and estimated value
NL = not listed
µg/L = micrograms per liter

TABLE B-2.1b
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN - SUPPLEMENTAL EVALUATION
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

Scenario Timeframe:	Current/Future
Medium:	Groundwater
Exposure Medium:	Groundwater

Exposure Point	CAS No.	Chemical	Minimum Concentration (Qualifier)		Maximum Concentration (Qualifier)		Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit		Concentration Used for Screening [1]	Background Value [2]	Screening Toxicity Value (n/c) [3]		Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Yes/No)	Rationale for Selection or Deletion [4]
Tap Water	**Volatile Organic Compounds**																		
	71-55-6	1,1,1-Trichloroethane	0.1	J	30		µg/L	MLS-3-125-0414	51 / 102	0.5	/ 20	30	NA	800	n	NA	NA	No	BSL
	79-34-5	1,1,2,2-Tetrachloroethane	0.24	J	0.24	J	µg/L	MLS-7-82-1114	1 / 102	0.5	/ 0.5	0.24	NA	0.076	c	NA	NA	No	IFD
	75-34-3	**1,1-Dichloroethane**	**0.12**	**J**	**35**		**µg/L**	**MW-1-60-1114**	**57 / 102**	**0.5**	**/ 2.5**	**35**	**NA**	**2.8**	**c**	**NA**	**NA**	**Yes**	**ASL**
	75-35-4	1,1-Dichloroethene	0.14	J	3.1		µg/L	MW-1-60-1114	27 / 102	0.5	/ 0.5	3.1	NA	28	n	NA	NA	No	BSL
	87-61-6	**1,2,3-Trichlorobenzene**	**0.63**	**JN**	**24**	**JN**	**µg/L**	**MLS-2-180-1114**	**7 / 102**	**0.5**	**/ 0.5**	**24**	**NA**	**0.7**	**n**	**NA**	**NA**	**Yes**	**ASL**
	120-82-1	1,2,4-Trichlorobenzene	0.22	J	0.32	J	µg/L	MW-6-1114	5 / 102	0.5	/ 0.5	0.32	NA	0.4	n	NA	NA	No	IFD
	95-50-1	1,2-Dichlorobenzene	0.13	J	16		µg/L	MW-1-98-1114 MW-1-60-1114	22 / 102	0.5	/ 0.5	16	NA	30	n	NA	NA	No	BSL
	107-06-2	**1,2-Dichloroethane**	**0.1**	**J**	**0.34**	**J**	**µg/L**	**MW-1-60-1114**	**7 / 102**	**0.5**	**/ 0.5**	**0.34**	**NA**	**0.17**	**c**	**NA**	**NA**	**Yes**	**ASL**
	541-73-1	1,3-Dichlorobenzene	0.11	J	1.5		µg/L	MW-1-98-1114, MW-1-60-1114	15 / 102	0.5	/ 0.5	1.5	NA	NA		NA	NA	No	NTX
	106-46-7	**1,4-Dichlorobenzene**	**0.13**	**J**	**13**		**µg/L**	**MW-1-98-1114 MW-1-60-1114**	**21 / 102**	**0.5**	**/ 0.5**	**13**	**NA**	**0.48**	**c**	**NA**	**NA**	**Yes**	**ASL**
	78-93-3	2-Butanone	2.9	J	77		µg/L	MLS-4-376-1114	10 / 102	5	/ 5	77	NA	560	n	NA	NA	No	BSL
	67-64-1	Acetone	1.9	J	190		µg/L	MLS-3-189-1114	22 / 102	5	/ 14	190	NA	1400	n	NA	NA	No	BSL
	71-43-2	**Benzene**	**0.11**	**J**	**1.6**		**µg/L**	**MW-1-60-1114 MW-1-98-1114**	**30 / 102**	**0.5**	**/ 0.5**	**1.6**	**NA**	**0.46**	**c**	**NA**	**NA**	**Yes**	**TOX**
	74-97-5	Bromochloromethane	0.15	J	0.15	J	µg/L	MLS-2-180-1114	1 / 102	0.5	/ 0.5	0.15	NA	8.3	n	NA	NA	No	IFD
	75-27-4	**Bromodichloromethane**	**0.1**	**J**	**0.71**		**µg/L**	**MLS-2-180-1114**	**22 / 102**	**0.5**	**/ 0.5**	**0.71**	**NA**	**0.13**	**c**	**NA**	**NA**	**Yes**	**ASL**
	75-15-0	Carbon Disulfide	0.12	J	0.83	J	µg/L	MW-10-1115	8 / 102	0.5	/ 0.5	0.83	NA	81	n	NA	NA	No	BSL
	108-90-7	**Chlorobenzene**	**0.28**	**J**	**70**		**µg/L**	**MW-1-60-1114**	**25 / 102**	**0.5**	**/ 5**	**70**	**NA**	**7.8**	**n**	**NA**	**NA**	**Yes**	**ASL**
	75-00-3	Chloroethane	0.43	J	1.2		µg/L	MLS-2-70-1114	2 / 102	0.5	/ 0.5	1.2	NA	2100	n	NA	NA	No	IFD
	67-66-3	**Chloroform**	**0.23**	**J**	**7.4**		**µg/L**	**MLS-2-180-1114**	**42 / 102**	**0.5**	**/ 0.5**	**7.4**	**NA**	**0.22**	**c**	**NA**	**NA**	**Yes**	**ASL**
	74-87-3	Chloromethane	0.11	J	1.1	J	µg/L	MW-10-1115	4 / 102	0.5	/ 0.5	1.1	NA	19	n	NA	NA	No	IFD
	156-59-2	**cis-1,2-Dichloroethene**	**0.18**	**J**	**93**	**J+**	**µg/L**	**MLS-3-80-0414**	**75 / 102**	**0.5**	**/ 20**	**93**	**NA**	**3.6**	**n**	**NA**	**NA**	**Yes**	**ASL**
	110-82-7	Cyclohexane	0.25	J	0.28	J	µg/L	MW-1-98-1114	3 / 102	0.5	/ 0.5	0.28	NA	1300	n	NA	NA	No	IFD
	100-41-4	Ethylbenzene	0.34	J	0.92		µg/L	MW-1-98-0414	3 / 102	0.5	/ 0.5	0.92	NA	1.5	c	NA	NA	No	IFD
	98-82-8	Isopropylbenzene	1.2		6.1		µg/L	MW-1-98-0414	8 / 102	0.5	/ 0.5	6.1	NA	45	n	NA	NA	No	BSL
	179601-23-1	m,p-Xylene	0.21	J	0.21	J	µg/L	MW-1-98-0414	1 / 101	0.5	/ 0.5	0.21	ND	19	n[5]	NA	NA	No	IFD
	1634-04-4	Methyl Tert-Butyl Ether	0.15	J	0.15	J	µg/L	MLS-11-215-1114	1 / 102	0.5	/ 0.5	0.15	NA	14	c	NA	NA	No	IFD
	75-09-2	Methylene Chloride	0.1	J	1		µg/L	MLS-2-180-1114	5 / 102	0.5	/ 0.5	1	NA	11	n	NA	NA	No	IFD
	95-47-6	o-Xylene	0.23	J	5.2		µg/L	MLS-6-65-1114	5 / 102	0.5	/ 0.5	5.2	ND	19	n	NA	NA	No	IFD
	127-18-4	**Tetrachloroethene**	**0.11**	**J**	**4.7**		**µg/L**	**MLS-1-300-0414**	**35 / 102**	**0.5**	**/ 0.5**	**4.7**	**0.22**	**4.1**	**n**	**NA**	**NA**	**Yes**	**ASL**
	108-88-3	**Toluene**	**0.22**	**J**	**200**		**µg/L**	**MLS-1-357-0414**	**58 / 102**	**0.5**	**/ 13**	**200**	**NA**	**110**	**n**	**NA**	**NA**	**Yes**	**ASL**
	156-60-5	trans-1,2-Dichloroethene	0.1	J	0.69	J+	µg/L	MLS-3-125-0414	34 / 102	0.5	/ 0.5	0.69	NA	36	n	NA	NA	No	BSL
	79-01-6	**Trichloroethene**	**0.11**	**J**	**280**		**µg/L**	**MLS-3-80-0414 MLS-3-125-0414**	**73 / 102**	**0.5**	**/ 20**	**280**	**NA**	**0.28**	**n**	**NA**	**NA**	**Yes**	**TOX**
	75-01-4	**Vinyl Chloride**	**0.12**	**J**	**50**		**µg/L**	**MLS-6-65-1114**	**18 / 102**	**0.5**	**/ 5**	**50**	**NA**	**0.019**	**c**	**NA**	**NA**	**Yes**	**TOX**
	Semi-volatile Organic Compounds								/		/								
	123-91-1	**1,4-Dioxane**	**0.05**	**J**	**26**		**µg/L**	**MLS-3-125-1114 MLS-3-189-1114**	**53 / 102**	**0.5**	**/ 5**	**26**	**NA**	**0.46**	**c**	**NA**	**NA**	**Yes**	**ASL**

TABLE B-2.1b
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN - SUPPLEMENTAL EVALUATION
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

Scenario Timeframe:	Current/Future
Medium:	Groundwater
Exposure Medium:	Groundwater

Exposure Point	CAS No.	Chemical	Minimum Concentration (Qualifier)		Maximum Concentration (Qualifier)		Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit		Concentration Used for Screening [1]	Background Value [2]	Screening Toxicity Value (n/c) [3]		Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Yes/No)	Rationale for Selection or Deletion [4]
	91-57-6	2-Methylnaphthalene	0.017	J	0.15		µg/L	MLS-5-49-1114	12 / 71	0.1	5	0.15	NA	3.6	n	NA	NA	No	BSL
	95-48-7	2-Methylphenol	1.4	J	3.9	J	µg/L	MLS-3-125-0414	3 / 71	5	5	3.9	NA	93	n	NA	NA	No	IFD
	106-44-5	4-Methylphenol	1.8	J	1.8	J	µg/L	MLS-3-125-0414	1 / 71	5	5	1.8	NA	190	n	NA	NA	No	IFD
	83-32-9	Acenaphthene	0.038	J	0.11		µg/L	MW-6-0414	6 / 71	0.1	5	0.11	NA	53	n	NA	NA	No	BSL
	208-96-8	Acenaphthylene	0.24	J	0.24	J	µg/L	MLS-2-70-1114	1 / 71	0.1	5	0.24	NA	53	n[6]	NA	NA	No	IFD
	120-12-7	Anthracene	0.086	J	0.086	J	µg/L	MW-6-0414	1 / 71	0.1	5	0.086	NA	180	n	NA	NA	No	IFD
	56-55-3	Benzo(a)anthracene	0.035	J	0.035	J	µg/L	MLS-7-82-1114	1 / 71	0.1	5	0.035	NA	0.012	c	NA	NA	No	IFD
	205-99-2	Benzo(b)fluoranthene	0.15	J	0.15	J	µg/L	MLS-6-215-1114	1 / 71	0.1	5	0.15	NA	0.034	c	NA	NA	No	IFD
	117-81-7	**Bis(2-Ethylhexyl)Phthalate**	**1.1**	**J**	**12**		**µg/L**	**MLS-4-88-1114**	**7 / 71**	**5**	**5**	**12**	**ND**	**5.6**	**c**	**NA**	**NA**	**Yes**	**ASL**
	105-60-2	Caprolactam	1.2	J	190	J	µg/L	MW-2-19-0414	23 / 71	5	25	190	NA	990	n	NA	NA	No	BSL
	218-01-9	Chrysene	0.015	J	0.015	J	µg/L	MLS-7-82-1114	1 / 71	0.1	5	0.015	NA	3.4	c	NA	NA	No	IFD
	84-66-2	Diethylphthalate	1.3	J	5.8		µg/L	MLS-6-45-1114	3 / 71	5	5	5.8	NA	1500	n	NA	NA	No	IFD
	206-44-0	Fluoranthene	0.23		0.23		µg/L	MW-6-0414	1 / 71	0.1	5	0.23	NA	80	n	NA	NA	No	IFD
	86-73-7	Fluorene	0.34		0.34		µg/L	MW-6-0414	1 / 71	0.1	5	0.34	NA	29	n	NA	NA	No	IFD
	78-59-1	Isophorone	2.6	J	2.6	J	µg/L	MLS-1-244-0414	1 / 71	5	5	2.6	NA	78	c	NA	NA	No	IFD
	91-20-3	**Naphthalene**	**0.03**	**J**	**0.26**		**µg/L**	**MLS-5-49-1114**	**17 / 71**	**0.1**	**5**	**0.26**	**NA**	**0.17**	**c**	**NA**	**NA**	**Yes**	**ASL**
	85-01-8	Phenanthrene	0.022	J	0.58		µg/L	MW-6-0414	14 / 71	0.1	5	0.58	NA	12	n[7]	NA	NA	No	BSL
	129-00-0	Pyrene	0.2		0.2		µg/L	MW-6-0414	1 / 71	0.1	5	0.2	NA	12	n	NA	NA	No	IFD
	Inorganics								/										
	7429-90-5	**Aluminum**	**2.1**	**J**	**5290**		**µg/L**	**MW-4-1114**	**68 / 103**	**20**	**40**	**5290**	**NA**	**2000**	**n**	**NA**	**NA**	**Yes**	**ASL**
	7440-36-0	Antimony	2.3		5.2		µg/L	MLS-4-376-1114	5 / 103	1	2	5.2	NA	0.78	n	NA	NA	No	IFD
	7440-38-2	Arsenic	1.2		3.6		µg/L	MW-4-1114	3 / 103	1	2	3.6	NA	0.052	c	NA	NA	No	IFD
	7440-39-3	**Barium**	**5.3**	**J**	**970**		**ug/l**	**MW-9-1115**	**102 / 103**	**1**	**35.1**	**970**	**NA**	**380**	**n**	**NA**	**NA**	**Yes**	**ASL**
	7440-41-7	Beryllium	0.043	J	0.71	J	ug/l	MW-4-1114	5 / 103	1	2	0.71	NA	2.5	n	NA	NA	No	IFD
	7440-43-9	Cadmium	0.048	J	0.36	J	ug/l	MW-4-1114	20 / 103	1	1	0.36	NA	0.92	n[8]	NA	NA	No	BSL
	7440-70-2	Calcium	3620		430000		ug/l	MW-10-1115	103 / 103	250	2500	430000	NA	NA		NA	NA	No	NUT
	7440-47-3	**Chromium**	**0.13**	**J**	**622**		**ug/l**	**MLS-3-125-1114**	**78 / 103**	**1**	**4**	**622**	**NA**	**0.035**	**c[9]**	**NA**	**NA**	**Yes**	**ASL**
	7440-48-4	**Cobalt**	**0.055**	**J**	**21.5**		**ug/l**	**MW-4-1114**	**32 / 103**	**0.091**	**2**	**21.5**	**NA**	**0.6**	**n**	**NA**	**NA**	**Yes**	**ASL**
	7440-50-8	Copper	0.29	J	33.4		ug/l	MW-4-1114	78 / 103	1	4	33.4	NA	80	n	NA	NA	No	BSL
	7439-89-6	**Iron**	**78.3**	**J**	**30100**		**ug/l**	**MW-1-98-1114**	**84 / 103**	**20**	**400**	**30100**	**NA**	**1400**	**n**	**NA**	**NA**	**Yes**	**ASL**
	7439-92-1	**Lead**	**0.32**	**J**	**22.8**		**ug/l**	**MLS-7-50-1114**	**76 / 103**	**0.24**	**2**	**22.8**	**NA**	**15**	**L**	**NA**	**NA**	**Yes**	**ASL**
	7439-95-4	Magnesium	686		140000		ug/l	MW-10-1115	103 / 103	250	1000	140000	NA	NA		NA	NA	No	NUT
	7439-96-5	**Manganese**	**4**		**4430**		**ug/l**	**MW-5-0414**	**103 / 103**	**1**	**25**	**4430**	**NA**	**43**	**n[10]**	**NA**	**NA**	**Yes**	**ASL**
	7439-97-6	Mercury	0.26		0.26		ug/l	MW-4-1114	1 / 103	0.2	0.2	0.26	NA	0.57	n[11]	NA	NA	No	IFD
	7440-02-0	**Nickel**	**0.25**	**J**	**1260**		**µg/L**	**MLS-3-125-1114**	**81 / 103**	**1**	**20**	**1260**	**NA**	**39**	**n[12]**	**NA**	**NA**	**Yes**	**ASL**
	7440-09-7	Potassium	335	J	8300		µg/L	MW-10-1115	86 / 103	250	1000	8300	NA	NA		NA	NA	No	NUT
	7782-49-2	Selenium	0.17	J	0.73	J	µg/L	MLS-1-357-1114	5 / 103	2	10	0.73	NA	10	n	NA	NA	No	IFD
	7440-22-4	Silver	0.05	J	0.14	J	µg/L	MLS-3-310-0414	11 / 103	1	1	0.14	NA	9.4	n	NA	NA	No	BSL
	7440-23-5	Sodium	2220		310000		µg/L	MW-9-1115	103 / 103	250	2500	310000	NA	NA		NA	NA	No	NUT
	7440-28-0	Thallium	0.037	J	0.063	J	µg/L	MLS-7-82-1114	2 / 103	1	1	0.063	NA	0.02	n[13]	NA	NA	No	IFD

TABLE B-2.1b
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN - SUPPLEMENTAL EVALUATION
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

Scenario Timeframe:	Current/Future
Medium:	Groundwater
Exposure Medium:	Groundwater

Exposure Point	CAS No.	Chemical	Minimum Concentration (Qualifier)		Maximum Concentration (Qualifier)		Unit	Location of Maximum Concentration	Detection Frequency			Range of Reporting Limit			Concentration Used for Screening [1]	Background Value [2]	Screening Toxicity Value (n/c) [3]		Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Yes/No)	Rationale for Selection or Deletion [4]
	7440-62-2	**Vanadium**	**0.088**	**J**	**15.6**		**µg/L**	**MW-4-1114**	**12**	**/**	**103**	**1**	**/**	**10**	**15.6**	**NA**	**8.6**	**n[14]**	**NA**	**NA**	**Yes**	**ASL**
	7440-66-6	Zinc	2.4		260		µg/L	MLS-11-367-1114	90	/	103	2	/	255	260	NA	600	n	NA	NA	No	BSL

[1] Maximum detected concentration used for screening.
[2] There is no background value available for groundwater.
[3] Screened against Regional Screening Levels, May 2016, for tap water, adjusted to a cancer risk of 1×10^{-6} and hazard quotient of 0.1. http://www.epa.gov/risk/risk-based-screening-table-generic-tables

[4] Rationale Codes:
Selection Reason: ASL = above screening level
TOX = Group A carcinogen
Deletion Reason: BSL = below screening level
IFD = detection frequency less than 5%
NUT = essential nutrient

ARAR/TBC = Applicable or Relevant and Appropriate Requiren
c = screening toxicity value based on cancer effects
COPC = chemical of potential concern
J = qualifier for estimated value
JN = qualifier for tentatively identified and estimated value
L = Federal Action Level
n = screening toxicity value based on noncancer effects
NA = not available
ND = not detected
NL = not listed
µg/L = micrograms per liter

[5] screening value for m-xylene
[6] screening value for acenaphthene
[7] screening value for pyrene
[8] screening value for cadmium (water)
[9] screening value for chromium VI
[10] screening value for manganese (non-diet)
[11] screening value for mercuric chloride (and other mercury salts)
[12] screening value for nickel soluble salts
[13] screening value for thallium soluble salts
[14] screening value for vanadium and compounds

TABLE B-3.1
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

Scenario Timeframe:	Current/Future
Medium:	Groundwater
Exposure Medium:	Groundwater

Exposure Point	Chemical of Potential Concern	Unit	Mean Concentration [1]	Upper Confidence Limit [1]	Maximum Concentration (Qualifier)	Exposure Point Concentration [2]			
						Value	Unit	Statistic [3]	Rationale [4]
Groundwater	**Volatile Organic Compounds**								
	1,1,2,2-Tetrachloroethane	µg/L	NA	NA	0.24 J	0.24	µg/L	Max	<4 detected values
	1,1-Dichloroethane	µg/L	7.6	27.1	35	27.1	µg/L	UCL-G	95% Adjusted Gamma UCL
	1,2,3-Trichlorobenzene	µg/L	8.9	8.5	24 JN	8.5	µg/L	UCL-NP	95% KM (t) UCL
	1,2-Dichloroethane	µg/L	0.19	0.29	0.34 J	0.29	µg/L	UCL-NP	95% KM (t) UCL
	1,4-Dichlorobenzene	µg/L	3.7	10.2	13	10.2	µg/L	UCL-NP	95% KM Bootstrap t UCL
	Benzene	µg/L	0.66	0.82	1.6	0.82	µg/L	UCL-NP	95% KM (t) UCL
	Bromodichloromethane	µg/L	0.37	0.47	0.71	0.47	µg/L	UCL-NP	95% KM (t) UCL
	Chlorobenzene	µg/L	31.2	31.5	70	31.5	µg/L	UCL-NP	95% KM (t) UCL
	Chloroform	µg/L	2.7	3.3	7.4	3.3	µg/L	UCL-NP	95% KM (t) UCL
	cis-1,2-Dichloroethene	µg/L	34.3	53.1	90	53	µg/L	UCL-N	95% Student's-t UCL
	Trichloroethene	µg/L	60.6	184	270	184	µg/L	UCL-G	95% Adjusted Gamma UCL
	Vinyl Chloride	µg/L	15.5	19.7	50	19.7	µg/L	UCL-NP	95% KM (t) UCL
	Semi-volatile Organic Compounds								
	1,4-Dioxane	µg/L	6.3	21.6	26	21.55	µg/L	UCL-G	95% Gamma Adjusted KM-UCL
	2,3,4,6-Tetrachlorophenol	µg/L	NA	NA	110 JN	110	µg/L	Max	<4 detected values
	Benzo(a)anthracene	µg/L	NA	NA	0.035 J	0.035	µg/L	Max	<4 detected values
	Benzo(b)fluoranthene	µg/L	NA	NA	0.15 J	0.15	µg/L	Max	<4 detected values
	Bis(2-Ethylhexyl)Phthalate	µg/L	5.1	6.0	12	6.0	µg/L	UCL-NP	95% KM (t) UCL
	Naphthalene	µg/L	0.103	0.13	0.26	0.13	µg/L	UCL-NP	95% KM (t) UCL
	Inorganics								
	Antimony	µg/L	NA	NA	5.2	5.2	µg/L	Max	<4 detected values
	Chromium	µg/L	70.5	682	622	622	µg/L	Max	UCL > Max
	Cobalt	µg/L	5.8	14.2	19.5	14.2	µg/L	UCL-G	95% Gamma Adjusted KM-UCL
	Iron	µg/L	5675	21304	30100	21304	µg/L	UCL-G	95% Adjusted Gamma UCL
	Lead	µg/L	10.2	NA	22.8	10.2	µg/L	Mean	Arithmetic Mean
	Manganese	µg/L	1267	3904	4370	3904	µg/L	UCL-G	95% Adjusted Gamma UCL
	Nickel	µg/L	149	1387	1260	1260	µg/L	Max	UCL > Max
	Thallium	µg/L	NA	NA	0.063 J	0.063	µg/L	Max	<4 detected values

µg/L = microgram per liter
NA = not applicable
J = qualifier for estimated value
JN = qualifier for tentatively identified and estimated value

Notes:

[1] Mean and upper confidence limit (UCL) concentrations are calculated using ProUCL version 5.1.00 for chemicals with at least 5 samples in a dataset and 4 detected values.

[2] Exposure point concentration is lower of maximum concentration and UCL.

[3] Statistic:
UCL-N = upper confidence limit of mean of normal distribution
UCL-NP = upper confidence limit of mean of non-parametric distribution
UCL-G = upper confidence limit of mean of gamma distribution
Max = maximum detected concentration
Mean = arithmetic mean

[4] Rationale: UCL statistic was selected based on the "Suggested UCL to Use" in ProUCL version 5.1.00 output. See Appendix C.

TABLE B-4.1a
VALUES USED FOR DAILY INTAKE CALCULATIONS FOR GROUNDWATER EXPOSURE PATHWAYS
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

Scenario Timeframe:	Future
Medium:	Groundwater
Exposure Medium:	Groundwater

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Unit	RME		CTE	
							Value	Rationale/ Reference	Value	Rationale/ Reference
Ingestion	Resident	Adult and Child (birth to <6 yrs)	Tap Water	CW	Chemical Concentration in Water	µg/L	Table B-3.1	Table B-3.1	Table B-3.1	Table B-3.1
				CF1	Conversion Factor 1	mg/µg	0.001	--	0.001	--
				$IR\text{-}W_a$	Ingestion Rate of Water - adult	L/day	2.5	EPA 2014	1	EPA 2011[(1)]
				$IR\text{-}W_c$	Ingestion Rate of Water - child	L/day	0.78	EPA 2014	0.39	EPA 2011[(2)]
				BW_a	Body Weight - adult	kg	80	EPA 2014	80	EPA 2014
				BW_c	Body Weight - child	kg	15	EPA 2014	15	EPA 2014
				ED_a	Exposure Duration - adult	years	20	EPA 2014	3	EPA 2004
				ED_c	Exposure Duration - child	years	6	EPA 2014	6	EPA 2004
				EF	Exposure Frequency	days/year	350	EPA 2014	350	EPA 2014
				AT-C	Averaging Time (Cancer)	days	25,550	EPA 2014	25,550	EPA 2014
				$AT\text{-}N_a$	Averaging Time (Noncancer) - adult	days	7,300	EPA 2014	1,095	EPA 2014
				$AT\text{-}N_c$	Averaging Time (Noncancer) - child	days	2,190	EPA 1989	2,190	EPA 1989
Dermal	Resident	Adult and Child (birth to <6 yrs)	Tap Water (Showering and Bathing)	CW	Chemical Concentration in Water	µg/L	Table B-3.1	Table B-3.1	Table B-3.1	Table B-3.1
				SA_a	Skin Surface Area Available for Contact - adult	cm^2/day	20,900	EPA 2014	20,900	EPA 2014
				SA_c	Skin Surface Area Available for Contact - child	cm^2/day	6,378	EPA 2014	6,378	EPA 2014
				$DA_{event\text{-}a}$	Absorbed Dose - adult	mg/cm^2	chemical specific	Table B-4.1b	chemical specific	Table B-4.1b
				$DA_{event\text{-}c}$	Absorbed Dose - child	mg/cm^2	chemical specific	Table B-4.1b	chemical specific	Table B-4.1b
				ET_a	Exposure Time - adult	hr/day	0.71	EPA 2014	0.36	EPA 2011[(3)]
				ET_c	Exposure Time - child	hr/day	0.54	EPA 2014	0.38	EPA 2011[(4)]
				EF	Exposure Frequency	days/year	350	EPA 2014	350	EPA 2014
				ED_a	Exposure Duration - adult	years	20	EPA 2014	3	EPA 2004
				ED_c	Exposure Duration - child	years	6	EPA 2014	6	EPA 2004
				BW_a	Body Weight - adult	kg	80	EPA 2014	80	EPA 2014
				BW_c	Body Weight - child	kg	15	EPA 2014	15	EPA 2014
				AT-C	Averaging Time (Cancer)	days	25,550	EPA 2014	25,550	EPA 2014
				$AT\text{-}N_a$	Averaging Time (Noncancer) - adult	days	7,300	EPA 2014	1,095	EPA 2014
				$AT\text{-}N_c$	Averaging Time (Noncancer) - child	days	2,190	EPA 1989	2,190	EPA 1989

TABLE B-4.1a
VALUES USED FOR DAILY INTAKE CALCULATIONS FOR GROUNDWATER EXPOSURE PATHWAYS
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

Scenario Timeframe:	Future
Medium:	Groundwater
Exposure Medium:	Groundwater

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Unit	RME		CTE	
							Value	Rationale/ Reference	Value	Rationale/ Reference
Inhalation	Resident	Adult and Child (birth to <6 yrs)	Tap Water (Showering and Bathing)	CW	Chemical Concentration in Water	µg/L	Table B-3.1	Table B-3.1	Table B-3.1	Table B-3.1
				CA_a	Chemical Concentration in Air - adult	$µg/m^3$	Table D-3	Table D-3	Table D-3	Table D-3
				CA_c	Chemical Concentration in Air - child	$µg/m^3$	Table D-4	Table D-4	Table D-4	Table D-4
				CF1	Conversion Factor 1	mg/µg	0.001	-	0.001	-
				ET_a	Exposure Time - adult	hr/day	0.71	EPA 2014	0.36	EPA 2011[3]
				ET_c	Exposure Time - child	hr/day	0.54	EPA 2014	0.38	EPA 2011[4]
				EF	Exposure Frequency	days/yr	350	EPA 2014	350	EPA 2014
				ED_a	Exposure Duration - adult	years	20	EPA 2014	3	EPA 2004
				ED_c	Exposure Furation - child	years	6	EPA 2014	6	EPA 2004
				AT-C	Averaging Time (Cancer)	hrs	613,200	EPA 2014	613,200	EPA 2014
				$AT\text{-}N_a$	Averaging Time (Noncancer) - adult	hrs	175,200	EPA 2014	26,280	EPA 2014
				$AT\text{-}N_c$	Averaging Time (Noncancer) - child	hrs	52,560	EPA 1989	52,560	EPA 1989

RME = Reasonable Maximum Exposure; CTE = Central Tendency Exposure

Notes:
[1] based on mean of consumer-only ingestion of drinking water (≥21 years old [Table 3-33])
[2] based on the weighted average of mean of consumer-only ingestion of drinking water (birth to <3 years old [Table 3-15] and 3 to <6 years old [Table 3-33])
[3] based on the weighted average of adult (21 to 78) mean time spent bathing/showering in a day (Table 16-31) divided by the mean number of baths/showers taken in a day (Table 16-30)
[4] based on the weighted average of mean time spent bathing (birth to <6 years) (Table 16-1)

Sources:
EPA 1989. Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002
EPA 2004. Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part E, Supplemental Guidance for Dermal Risk Assessment Final. EPA/540/R/99/005
EPA 2011. Exposure Factors Handbook: 2011 Edition. EPA/600/R-090/052F. September.
EPA 2014. Human Health Evaluation Manual, Supplemental Guidance: Update of Standard Default Exposure Factor. OSWER Directive 9200.1-120. February 6.

TABLE B-4.1b
EQUATIONS USED FOR DAILY INTAKE CALCULATIONS FOR GROUNDWATER EXPOSURE PATHWAYS
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

For residents

Ingestion Pathway

Carcinogenic

Nonmutagenic

$$DI = \frac{CW \times CF1 \times IR\text{-}W_a \times ED_a \times EF}{AT\text{-}C \times BW_a} + \frac{CW \times CF1 \times IR\text{-}W_c \times ED_c \times EF}{AT\text{-}C \times BW_c}$$

Mutagenic (Reasonable Maximum Exposure)

$$DI = \frac{CW \times CF1 \times \{(2yr \times IR\text{-}W_c \times 10/BW_c) + (4yr \times IR\text{-}W_c \times 3/BW_c) + (10yr \times IR\text{-}W_a \times 3/BW_a) + (10yr \times IR\text{-}W_a \times 1/BW_a)\} \times EF}{AT\text{-}C}$$

Mutagenic (Central Tendency Exposure)

$$DI = \frac{CW \times CF1 \times \{(2yr \times IR\text{-}W_c \times 10/BW_c) + (4yr \times IR\text{-}W_c \times 3/BW_c) + (3yr \times IR\text{-}W_a \times 3/BW_a)\} \times EF}{AT\text{-}C}$$

Trichloroethene - See Appendix B, Table B-7.0

Vinyl Chloride

$$DI = \frac{CW \times CF1 \times \{(IR\text{-}W_a \times ED_a/BW_a) + (IR\text{-}W_c \times ED_c/BW_c)\} \times EF}{AT\text{-}C} + CW \times CF1 \times IR\text{-}W_c/BW_c$$

Noncarcinogenic - Adult

$$DI = \frac{CW \times CF1 \times IR\text{-}W_a \times ED_a \times EF}{AT\text{-}N_a \times BW_a}$$

Noncarcinogenic - Child

$$DI = \frac{CW \times CF1 \times IR\text{-}W_c \times ED_c \times EF}{AT\text{-}N_c \times BW_c}$$

TABLE B-4.1b
EQUATIONS USED FOR DAILY INTAKE CALCULATIONS FOR GROUNDWATER EXPOSURE PATHWAYS
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

Dermal Contact Pathway

Carcinogenic

Nonmutagenic

$$DAD = \frac{SA_a \times DA_{event\text{-}a} \times ED_a \times EF}{AT\text{-}C \times BW_a} + \frac{SA_c \times DA_{event\text{-}c} \times ED_c \times EF}{AT\text{-}C \times BW_c}$$

Mutagenic (Reasonable Maximum Exposure)

$$DAD = \frac{\{(2yr \times SA_c \times DA_{event\text{-}c} \times 10/BW_c) + (4yr \times SA_c \times DA_{event\text{-}c} \times 3/BW_c) + (10yr \times SA_a \times DA_{event\text{-}a} \times 3/BW_a) + (10yr \times SA_a \times DA_{event\text{-}a} \times 1/BW_a)\} \times EF}{AT}$$

Mutagenic (Central Tendency Exposure)

$$DAD = \frac{\{(2yr \times SA_c \times DA_{event\text{-}c} \times 10/BW_c) + (4yr \times SA_c \times DA_{event\text{-}c} \times 3/BW_c) + (3yr \times SA_a \times DA_{event\text{-}a} \times 3/BW_a)\} \times EF}{AT}$$

Trichloroethene - See Appendix B, Table B-7.0

Vinyl Chloride

$$DAD = \frac{\{(SA_a \times DA_{event\text{-}a} \times ED_a/BW_a) + (SA_c \times DA_{event\text{-}c} \times ED_c/BW_c)\} \times EF}{AT} + SA_c \times DA_{event\text{-}c}/BW_c$$

Noncarcinogenic - Adult

$$DAD = \frac{SA_a \times DA_{event\text{-}a} \times ED_a \times EF}{AT\text{-}N_a \times BW_a}$$

Noncarcinogenic - Child

$$DAD = \frac{SA_c \times DA_{event\text{-}c} \times ED_c \times EF}{AT\text{-}N_c \times BW_c}$$

Inhalation Pathway

Carcinogenic

Nonmutagenic

$$EC = CF1 \times CA_a \times ET_a \times ED_a \times EF / AT\text{-}C + CF1 \times CA_c \times ET_c \times ED_c \times EF / AT\text{-}C$$

Mutagenic (Reasonable Maximum Exposure)

$$EC = CF1 \times \{(CA_c \times 2yr \times 10 \times ET_c) + (CA_c \times 4yr \times 3 \times ET_c) + (CA_a \times 10yr \times 3 \times ET_a) + (CA_a \times 10yr \times 1 \times ET_a)\} \times EF / AT$$

Mutagenic (Central Tendency Exposure)

$$EC = CF1 \times \{(CA_c \times 2yr \times 10 \times ET_c) + (CA_c \times 4yr \times 3 \times ET_c) + (CA_a \times 3yr \times 3 \times ET_a)\} \times EF / AT$$

Trichloroethene - See Appendix B, Table B-7.0

Vinyl Chloride

$$EC = CF1 \times \{(CA_a \times ET_a \times ED_a) + (CA_c \times ET_c \times ED_c)\} \times EF/AT + (CF1 \times CA_c)$$

Noncarcinogenic - Adult

$$EC = CF1 \times CA_a \times ET_a \times ED_a \times EF / AT\text{-}N_a$$

Noncarcinogenic - Child

$$EC = CF1 \times CA_c \times ET_c \times ED_c \times EF / AT\text{-}N_c$$

TABLE B-4.1b
EQUATIONS USED FOR DAILY INTAKE CALCULATIONS FOR GROUNDWATER EXPOSURE PATHWAYS
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

Sources:

EPA 1989. Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.
EPA 2000. Toxicological Review of Vinyl Chloride (CAS No. 75-01-4) in Support of Summary Information on the Integrated Risk Information System (IRIS). May.
EPA 2004. Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part E, Supplemental Guidance for Dermal Risk Assessment Final. EPA/540/R/99/005.
EPA 2005. Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens. EPA/630/R-03/003F.
http://www.epa.gov/oswer/riskassessment/sghandbook/chemicals.htm. March.
EPA 2009. Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part F, Supplemental Guidance for Inhalation Risk Assessment. EPA-540-R-070-002.
EPA 2011. Toxicological Review of Trichloroethylene (CAS No. 79-01-6) in Support of Summary Information on the Integrated Risk Information System (IRIS). September.

DI	Daily intake	mg/kg-day
DAD	Dermally Absorbed Dose	mg/kg-day
CW	Chemical Concentration in Water	µg/L
CF1	Conversion Factor 1	mg/µg
IR-W_a	Ingestion Rate of Water - adult	L/day
IR-W_c	Ingestion Rate of Water - child	L/day
SA_a	Skin Surface Area Available for Contact - adult	cm^2/day
SA_c	Skin Surface Area Available for Contact - child	cm^2/day
$DA_{event-a}$	Absorbed Dose - adult (Table B-4.5)	mg/cm^2
$DA_{event-c}$	Absorbed Dose - child (Table B-4.5)	mg/cm^2
EC	Exposure Concentration	mg/m^3
CA_a	Chemical Concentration in Air - adult (Table D-3)	$µg/m^3$
CA_c	Chemical Concentration in Air - child (Table D-4)	$µg/m^3$
ET_a	Exposure Time - adult	hrs/day
ET_c	Exposure Time - child	hrs/day
EF	Exposure Frequency	days/year
ED_a	Exposure Duration - adult	years
ED_c	Exposure Duration - child	years
BW_a	Body Weight - adult	kg
BW_c	Body Weight - child	kg
AT-C	Averaging Time (Cancer)	days or hrs
	AT-C = 70 years x 365 days /year	
AT-N_a	Averaging Time (Noncancer) - adult	days or hrs
AT-N_c	Averaging Time (Noncancer) - child	days or hrs
	AT-N = ED x 365 days/year	
	AT-N = ED x 365 days/year x 24 hr/day -- inhalation pathway	

TABLE B-4.2
CHEMICAL-SPECIFIC INFORMATION USED FOR DAILY INTAKE CALCULATIONS
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

Chemical	Permeability Coefficient [1]	Fraction absorbed water[1]	Lag time per event[1]	Time to reach steady state[1]	B[1]	DA_{event}[2] Resident	Henry's Law Constant[3]		Diffusivity in Air[3]	Diffusivity in Water[3]	Soil Organic Carbon Partition Coefficient[3]	Soil-Water Partition Coefficient	Apparent Diffusivity[4]	Volatilization factor[4]	Fraction Volatilized[5]
	(cm/hr)	Unitless	(hr/event)	(hr)	(Unitless)	(mg/cm^2)	($atm\text{-}m^3/mole$)	Unitless	(cm^2/s)	(cm^2/s)	(L/kg)	(cm^3/g)	(cm^2/s)	(m^3/kg)	Unitless
Volatile Organic Compounds															
1,1,2,2-Tetrachloroethane	6.9E-03	1.0E+00	9.3E-01	2.2E+00	0.0E+00	3.6E-09	3.7E-04	1.5E-02	4.9E-02	9.3E-06	9.3E-06	5.6E-08	3.7E-04	6.5E+03	4.9E-01
1,1-Dichloroethane	6.7E-03	1.0E+00	3.8E-01	9.2E-01	0.0E+00	2.5E-07	5.6E-03	2.3E-01	8.4E-02	1.1E-05	3.2E+01	1.9E-01	3.0E-03	2.3E+03	5.4E-01
1,2,3-Trichlorobenzene	NA	NA	NA	NA	NA	NA	1.3E-03	5.1E-02	4.0E-02	8.4E-06	1.4E+03	8.3E+00	1.2E-05	3.5E+04	4.6E-01
1,2-Dichloroethane	4.2E-03	1.0E+00	3.8E-01	9.2E-01	0.0E+00	1.7E-09	1.2E-03	4.8E-02	8.6E-02	1.1E-05	8.6E-02	5.1E-04	2.0E-03	2.8E+03	5.5E-01
1,4-Dichlorobenzene	4.2E-02	1.0E+00	7.1E-01	1.7E+00	2.0E+00	8.2E-07	2.4E-03	9.9E-02	5.5E-02	8.7E-06	5.5E-02	8.7E-06	2.4E-03	2.5E+03	4.7E-01
Benzene	1.5E-02	1.0E+00	2.9E-01	7.0E-01	1.0E-01	1.5E-08	5.6E-03	2.3E-01	9.0E-02	1.0E-05	1.5E+02	8.7E-01	1.0E-03	3.9E+03	5.3E-01
Bromodichloromethane	4.6E-03	1.0E+00	8.8E-01	2.1E+00	0.0E+00	4.6E-09	2.1E-03	8.7E-02	5.6E-02	1.1E-05	3.2E+01	1.9E-01	8.2E-04	4.3E+03	5.4E-01
Chlorobenzene	2.8E-02	1.0E+00	4.6E-01	1.1E+00	1.0E-01	1.4E-06	3.1E-03	1.3E-01	7.2E-02	9.5E-06	2.3E+02	1.4E+00	3.1E-04	7.0E+03	5.0E-01
Chloroform	6.8E-03	1.0E+00	5.0E-01	1.2E+00	0.0E+00	3.6E-08	3.7E-03	1.5E-01	7.7E-02	1.1E-05	3.2E+01	1.9E-01	1.9E-03	2.9E+03	5.5E-01
cis-1,2-Dichloroethene	NA	NA	NA	NA	NA	NA	4.1E-03	1.7E-01	8.8E-02	1.1E-05	4.0E+01	2.4E-01	2.1E-03	2.7E+03	5.6E-01
Trichloroethene	1.2E-02	1.0E+00	5.8E-01	1.4E+00	1.0E-01	3.8E-06	9.9E-03	4.0E-01	6.9E-02	1.0E-05	6.1E+01	3.6E-01	2.7E-03	2.4E+03	5.3E-01
Vinyl Chloride	5.6E-03	1.0E+00	2.4E-01	5.7E-01	0.0E+00	1.3E-07	2.8E-02	1.1E+00	1.1E-01	1.2E-05	2.2E+01	1.3E-01	1.4E-02	1.0E+03	5.9E-01
Semi-volatile Organic Compounds															
1,4-Dioxane	3.3E-04	1.0E+00	3.3E-01	8.0E-01	0.0E+00	9.2E-09	4.8E-06	2.0E-04	8.7E-02	1.1E-05	2.6E+00	1.6E-02	8.2E-06	4.3E+04	5.4E-01
2,3,4,6-Tetrachlorophenol	NA	NA	NA	NA	NA	NA	8.8E-06	3.6E-04	5.0E-02	5.9E-06	2.8E+02	1.7E+00	5.5E-07	NA	NA
Benzo(a)anthracene	4.7E-01	1.0E+00	2.0E+00	8.5E+00	2.8E+00	5.3E-08	1.2E-05	4.9E-04	2.6E-02	6.7E-06	1.8E+05	1.1E+03	6.7E-10	NA	NA
Benzo(b)fluoranthene	7.0E-01	1.0E+00	2.8E+00	1.2E+01	4.3E+00	4.0E-07	6.6E-07	2.7E-05	4.8E-02	5.6E-06	6.0E+05	3.6E+03	2.8E-11	NA	NA
Bis(2-Ethylhexyl)Phthalate	2.5E-02	8.0E-01	1.7E+01	4.0E+01	2.0E-01	1.1E-06	2.7E-07	1.1E-05	1.7E-02	4.2E-06	1.2E+05	7.2E+02	5.1E-11	NA	NA
Naphthalene	4.7E-02	1.0E+00	5.6E-01	1.3E+00	2.0E-01	1.0E-08	4.4E-04	1.8E-02	6.0E-02	8.4E-06	1.5E+03	9.3E+00	6.0E-06	5.1E+04	4.6E-01
Inorganics															
Antimony	1.0E-03	NA	NA	NA	NA	3.5E-09	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium	2.0E-03	NA	NA	NA	NA	8.3E-07	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cobalt	4.0E-04	NA	NA	NA	NA	3.8E-09	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron	1.0E-03	NA	NA	NA	NA	1.4E-05	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese	1.0E-03	NA	NA	NA	NA	2.6E-06	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nickel	2.0E-04	NA	NA	NA	NA	1.7E-07	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thallium	1.0E-03	NA	NA	NA	NA	4.2E-11	NA	NA	NA	NA	NA	NA	NA	NA	NA

NA - Not applicable

Notes:

[1] Source: EPA 2004. Risk Assessment Guidance for Superfund. Part E.

[2] Absorbed dose per event is calculated using Equations 3.2, 3.3, and 3.4 from EPA 2004 (p.3-4)

for organics:

$$\text{If } t_{event} \le t^*, DA_{event} = 2FA \times K_p \times C_W \sqrt{\frac{6\tau_{event} \times t_{event}}{\pi}} \qquad \text{If } t_{event} > t^*, DA_{event} = FA \times K_p \times C_W \left[\frac{t_{event}}{1+B} + 2\tau_{event}\left(\frac{1+3B+3B^2}{(1+B)^2}\right)\right]$$

for inorganics:

$$DA_{event} = K_p \times C_W \times t_{event}$$

Where:

DA_{event} = absorbed dose per event, mg/cm^2

FA = fraction absorbed water

K_p = permeability coefficient, cm/hr

CW = chemical concentration in water, mg/cm^3 (converted from µg/L from Tables B-3.3 and B-3.4 by dividing by 1,000,000)

TABLE B-4.2
CHEMICAL-SPECIFIC INFORMATION USED FOR DAILY INTAKE CALCULATIONS
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

τ_{event} = lag time per event, hr

t_{event} = event duration, hr

t* = time to reach steady-state, hr

B = dimensionless ratio of the permeability coefficient of a compound through the stratum corneum relative to its permeability coefficient across the viable epidermis

(3) Source: EPA 2016. Regional Screening Levels for Chemical Contaminants at Superfund Sites. May.

(4) Volatilization Factor is calculated using Equation 4-8 from Soil Screening Guidance (EPA 2002) (p.4-24)

$$D_A = \frac{{}^{/3} D_i H' + \theta_w{}^{10/3} D_i}{\rho_b K_d + \theta_w + \theta_a H'}$$

$$VF = \frac{Q/C \times (3.14 \times D_A \times T)^{1/2} \times 10^{-4}\ (m^2/cm^2)}{(2 \times \rho_b \times D_A)}$$

where:

VF = volatilization factor, m^3/kg

Di = diffusion coefficient in air, cm^2/s

Dw = diffusion coefficient in water, cm^2/s

K_d = soil-water partition coefficient, $cm^3/g = K_{oc} \times f_{oc}$

f_{oc} = fraction organic carbon in soil, g/g = 0.006

K_{oc} = soil organic carbon partition coefficient, cm^3/g

T = exposure interval, $s = 9.5 \times 10^8$

H' = Dimensionless Henry's law constant

D_A = apparent diffusivity, cm^2/s

θ_a = air filled soil porosity = $n - \theta_w = 0.28$

θ_w = water-filled soil porosity = 0.15

n = total porosity = $1 - \rho_b/\rho_s = 0.43$

ρ_b = dry soil bulk density, $g/cm^3 = 1.5$

ρ_s = soil particle density, $g/cm^3 = 2.65$

Q/C = inverse of the ratio of the geometric mean air concentration to the volatilization flux at center of a square source, g/m^2-s per $kg/m^3 = 68.18$

(5) Estimated for volatile chemicals using Equation 5 from Schaum et al (1994) (p. 308), with radon as the reference chemical (j):

$$f_i = f_j \times \frac{\left(2.5/D_W{}^{0.67} + RT/D_a{}^{0.67}H\right)_j}{\left(2.5/D_W{}^{0.67} + RT/D_a{}^{0.67}H\right)_i}$$

Where:

f_i = volatilization fraction for chemical i

f_j = volatilization fraction for chemical j = Radon

D_a = diffusion coefficient in air, m^2/s

D_w = diffusion coefficient in water, m^2/s

D_a for Radon = 2.0×10^{-5}

D_w for Radon = 1.4×10^{-9}

R = gas constant, atm-m^3/mol-K = 8.21×10^{-5}

H = Henry's law constant, atm-m^3/mol

T = temperature, K = 293

TABLE B-5.1
NONCANCER TOXICITY DATA - ORAL/DERMAL
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

Chemical of Potential Concern	Chronic/ Subchronic	Oral RfD		Oral Absorption Efficiency for Dermal [1]	Absorbed RfD for Dermal [2]		Primary Target Organ	Combined Uncertainty/ Modifying Factor	Source	Date [3]
		Value	Unit		Value	Unit				
Volatile Organic Compounds										
1,1,2,2-Tetrachloroethane	Chronic	2.0E-02	mg/kg-day	1	2.0E-02	mg/kg-day	Liver	1000	IRIS	11/12/2016
1,1-Dichloroethane	Chronic	2.0E-01	mg/kg-day	1	2.0E-01	mg/kg-day	Kidney	3,000	PPRTV	9/27/2006
1,2,3-Trichlorobenzene	Chronic	8.0E-04	mg/kg-day	1	8.0E-04	mg/kg-day	Body Weight/Liver/Thyroid	10000	PPRTV-S	9/11/2009
1,2-Dichloroethane	Chronic	6.0E-03	mg/kg-day	1	6.0E-03	mg/kg-day	Kidney	10000	PPRTV-S	10/1/2010
1,4-Dichlorobenzene	Chronic	7.0E-02	mg/kg-day	1	7.0E-02	mg/kg-day	Liver	100	ATSDR	12/1/2016
Benzene	Chronic	4.0E-03	mg/kg-day	1	4.0E-03	mg/kg-day	Blood	300	IRIS	11/12/2016
Bromodichloromethane	Chronic	2.0E-02	mg/kg-day	1	2.0E-02	mg/kg-day	Liver	1,000	IRIS	11/12/2016
Chlorobenzene	Chronic	2.0E-02	mg/kg-day	1	2.0E-02	mg/kg-day	Liver	1000	IRIS	11/12/2016
Chloroform	Chronic	1.0E-02	mg/kg-day	1	1.0E-02	mg/kg-day	Liver	100	IRIS	11/12/2016
cis-1,2-Dichloroethene	Chronic	2.0E-03	mg/kg-day	1	2.0E-03	mg/kg-day	Kidney	3,000	IRIS	11/12/2016
Trichloroethene	Chronic	5.0E-04	mg/kg-day	1	5.0E-04	mg/kg-day	Heart/ Immune System/ Developmental/Kidney	10 to 1,000	IRIS	11/12/2016
Vinyl Chloride	Chronic	3.0E-03	mg/kg-day	1	3.0E-03	mg/kg-day	Liver	30	IRIS	11/12/2016
Semi-volatile Organic Compounds										
1,4-Dioxane	Chronic	3.0E-02	mg/kg-day	1	3.0E-02	mg/kg-day	Liver/Kidney	300	IRIS	11/12/2016
2,3,4,6-Tetrachlorophenol	Chronic	3.0E-02	mg/kg-day	1	3.0E-02	mg/kg-day	Liver	1000	IRIS	11/12/2016
Benzo(a)anthracene	Chronic	NA	NA	1	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	Chronic	NA	NA	1	NA	NA	NA	NA	NA	NA
Bis(2-Ethylhexyl)Phthalate	Chronic	2.0E-02	mg/kg-day	1	2.0E-02	mg/kg-day	Liver	1,000	IRIS	11/12/2016
Naphthalene	Chronic	2.0E-02	mg/kg-day	1	2.0E-02	mg/kg-day	Body Weight	3000	IRIS	11/12/2016
Inorganics										
Antimony	Chronic	4.0E-04	mg/kg-day	0.15	6.0E-05	mg/kg-day	Longevity/Blood	1,000	IRIS	11/12/2016
Chromium[4]	Chronic	3.0E-03	mg/kg-day	0.025	7.5E-05	mg/kg-day	None reported	300	IRIS	11/12/2016
Cobalt	Chronic	3.0E-04	mg/kg-day	1	3.0E-04	mg/kg-day	Thyroid	3,000	PPRTV	8/25/2008
Iron	Chronic	7.0E-01	mg/kg-day	1	7.0E-01	mg/kg-day	GI Tract	1.5	PPRTV	9/11/2006
Lead	Chronic	NA	NA	1	NA	NA	NA	NA	NA	NA
Manganese	Chronic	1.4E-01	mg/kg-day	1	1.4E-01	mg/kg-day	CNS	1	IRIS	11/12/2016
Nickel[5]	Chronic	2.0E-02	mg/kg-day	0.04	8.0E-04	mg/kg-day	Body and Organ Weight	200	IRIS	12/1/2016
Thallium	Chronic	1.0E-05	mg/kg-day	1	1.0E-05	mg/kg-day	Skin/Hair	3,000	PPRTV-S	10/25/2012

[1] Oral Absorption Efficiency for Dermal from Regional Screening Levels, May 2016
http://www.epa.gov/risk/risk-based-screening-table-generic-tables

[2] Adjusted RfD for Dermal = Oral RfD x Oral Absorption Efficiency for Dermal.

[3] Date shown for IRIS is the date IRIS was searched. http://www.epa.gov/iris/
Date shown for other sources is the publication date.

[4] based on chromium (VI)

[5] based on nickel, soluble salt

Definition:
ATSDR = Agency for Toxic Substances and Disease Registry
CNS = central nervous system
GI = gastrointestinal
IRIS = Integrated Risk Information System
mg/kg-day = milligram per kilogram per day
NA = not available
PPRTV-S = Screening Provisional Peer Reviewed Toxicity Value
PPRTV = Provisional Peer Reviewed Toxicity Value
RfD = reference dose

TABLE B-5.2a
NONCANCER TOXICITY DATA - INHALATION (CHRONIC)
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

Chemical of Potential Concern	Inhalation RfC		Primary Target Organ	Combined Uncertainty/ Modifying Factor	RfC Target Organ	
	Value	Unit			Source	Date [1]
Volatile Organic Compounds						
1,1,2,2-Tetrachloroethane	NA	NA	NA	NA	NA	NA
1,1-Dichloroethane	NA	NA	NA	NA	NA	NA
1,2,3-Trichlorobenzene	NA	NA	NA	NA	NA	NA
1,2-Dichloroethane	7.0E-03	mg/m^3	Liver	3000	PPRTV	10/1/2010
1,4-Dichlorobenzene	8.0E-01	mg/m^3	Liver	100	IRIS	11/12/2016
Benzene	3.0E-02	mg/m^3	Blood	300	IRIS	11/12/2016
Bromodichloromethane	NA	NA	NA	NA	NA	NA
Chlorobenzene	5.0E-02	mg/m^3	Liver/Kidney	1000	PPRTV	10/12/2006
Chloroform	3.0E-01	mg/m^3	Alimentary System/Kidney/Developmental	300	Cal/EPA	6/1/2014
cis-1,2-Dichloroethene	NA	NA	NA	NA	NA	NA
Trichloroethene	2.0E-03	mg/m^3	Heart/Immune System/Liver	10 to 100	IRIS	11/12/2016
Vinyl Chloride	1.0E-01	mg/m^3	Liver	30	IRIS	11/12/2016
Semi-volatile Organic Compounds						
1,4-Dioxane	3.0E-02	mg/m^3	CNS/Respiratory System	1000	IRIS	11/12/2016
2,3,4,6-Tetrachlorophenol	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	NA	NA	NA	NA	NA	NA
Bis(2-Ethylhexyl)Phthalate	NA	NA	NA	NA	NA	NA
Naphthalene	3.0E-03	mg/m^3	CNS/Respiratory System	3000	IRIS	11/12/2016
Inorganics						
Antimony[2]	2.0E-04	mg/m^3	Lung	300	IRIS	11/10/2016
Chromium[3]	1.0E-04	mg/m^3	Lung	300	IRIS	11/12/2016
Cobalt	6.0E-06	mg/m^3	Respiratory Tract/Lung	300	PPRTV	8/25/2008
Iron	NA	NA	NA	NA	NA	NA
Lead	NA	NA	NA	NA	NA	NA
Manganese	5.0E-05	mg/m^3	CNS	1,000	IRIS	11/12/2016
Nickel	1.4E-05	mg/m^3	Respiratory System	100	Cal/EPA	6/1/2014
Thallium	NA	NA	NA	NA	NA	NA

[1] Date shown for IRIS is the date IRIS was searched. http://www.epa.gov/iris/
Date shown for other sources is the publication date.

[2] based on antimony trioxide

[3] based on chromium (VI) particulates

Definition:
Cal/EPA = California Environmental Protection Agency
CNS = central nervous system
IRIS = Integrated Risk Information System
mg/m^3 = milligram per cubic meter
NA = not available
PPRTV = Provisional Peer Reviewed Toxicity Value
RfC = reference concentration

TABLE B-6.1
CANCER TOXICITY DATA - ORAL/DERMAL
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

Chemical of Potential Concern	Oral Slope Factor		Oral Absorption Efficiency for Dermal [1]	Absorbed Slope Factor for Dermal [2]		Mutagen [3]	Weight of Evidence/ Cancer Guideline Description	Source	Date [4]
	Value	Unit		Value	Unit				
Volatile Organic Compounds									
1,1,2,2-Tetrachloroethane	2.0E-01	$(mg/kg\text{-}day)^{-1}$	1	2.0E-01	$(mg/kg\text{-}day)^{-1}$	--	Likely to be carcinogenic to humans	IRIS	11/12/2016
1,1-Dichloroethane	5.7E-03	$(mg/kg\text{-}day)^{-1}$	1	5.7E-03	$(mg/kg\text{-}day)^{-1}$	--	C	Cal/EPA	7/21/2009
1,2,3-Trichlorobenzene	NA	NA	1	NA	NA	--	NA	NA	NA
1,2-Dichloroethane	9.1E-02	$(mg/kg\text{-}day)^{-1}$	1	9.1E-02	$(mg/kg\text{-}day)^{-1}$	--	B2	IRIS	11/12/2016
1,4-Dichlorobenzene	5.4E-03	$(mg/kg\text{-}day)^{-1}$	1	5.4E-03	$(mg/kg\text{-}day)^{-1}$	--	2B	Cal/EPA	7/21/2009
Benzene	5.5E-02	$(mg/kg\text{-}day)^{-1}$	1	5.5E-02	$(mg/kg\text{-}day)^{-1}$	--	A	IRIS	11/12/2016
Bromodichloromethane	6.2E-02	$(mg/kg\text{-}day)^{-1}$	1	6.2E-02	$(mg/kg\text{-}day)^{-1}$	--	B2	IRIS	11/12/2016
Chlorobenzene	NA	NA	1	NA	NA	--	D	IRIS	11/12/2016
Chloroform	3.1E-02	$(mg/kg\text{-}day)^{-1}$	1	3.1E-02	$(mg/kg\text{-}day)^{-1}$	--	B2	Cal/EPA	2011
cis-1,2-Dichloroethene	NA	NA	1	NA	NA	--	inadequate information to assess the carcinogenic potential	IRIS	11/12/2016
Trichloroethene[5]	4.6E-02	$(mg/kg\text{-}day)^{-1}$	1	4.6E-02	$(mg/kg\text{-}day)^{-1}$	M	carcinogenic to humans	IRIS	11/12/2016
Vinyl Chloride[6]	7.2E-01	$(mg/kg\text{-}day)^{-1}$	1	7.2E-01	$(mg/kg\text{-}day)^{-1}$	M	A	IRIS	11/12/2016
Semi-volatile Organic Compounds									
1,4-Dioxane	1.0E-01	$(mg/kg\text{-}day)^{-1}$	1	1.0E-01	$(mg/kg\text{-}day)^{-1}$	--	Likely to be carcinogenic to humans	IRIS	11/12/2016
2,3,4,6-Tetrachlorophenol	NA	NA	1	NA	NA	--	NA	NA	NA
Benzo(a)anthracene	7.3E-01	$(mg/kg\text{-}day)^{-1}$	1	7.3E-01	$(mg/kg\text{-}day)^{-1}$	M	B2	EPA	7/1/1993
Benzo(b)fluoranthene	7.3E-01	$(mg/kg\text{-}day)^{-1}$	1	7.3E-01	$(mg/kg\text{-}day)^{-1}$	M	B2	EPA	7/1/1993
Bis(2-Ethylhexyl)Phthalate	1.4E-02	$(mg/kg\text{-}day)^{-1}$	1	1.4E-02	$(mg/kg\text{-}day)^{-1}$	--	B2	IRIS	11/12/2016
Naphthalene	NA	NA	1	NA			C	IRIS	11/12/2016
Inorganics									
Antimony	NA	NA	0.15	NA	NA	--	NA	NA	NA
Chromium[7]	5.0E-01	$(mg/kg\text{-}day)^{-1}$	0.025	2.0E+01	$(mg/kg\text{-}day)^{-1}$	--	likely to be carcinogenic to humans	NJDEP	4/8/2009
Cobalt	NA	NA	1	NA	NA	--	NA	NA	NA
Iron	NA	NA	1	NA	NA	--	inadequate information to assess the carcinogenic potential	PPRTV	9/11/2006
Lead	NA	NA	1	NA	NA	--	B2	IRIS	11/12/2016
Manganese	NA	NA	0.04	NA	NA	--	D	IRIS	11/12/2016
Nickel	NA	NA	0.04	NA	NA	--	NA	NA	NA
Thallium	NA	NA	1	NA	NA	--	inadequate information to assess the carcinogenic potential	PPRTV	10/25/2012

TABLE B-6.1
CANCER TOXICITY DATA - ORAL/DERMAL
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

(1) Oral Absorption Efficiency for Dermal from Regional Screening Levels, May 2016
http://www.epa.gov/risk/risk-based-screening-table-generic-tables

(2) Absorbed slope factor (SF) for Dermal = Oral SF / Oral Absorption Efficiency for Dermal

(3) Identified as a mutagen on the Regional Screening Level Table, May 2016

(4) Date shown for IRIS is the date IRIS was searched. http://www.epa.gov/iris/
Date shown for other sources is the publication date.

(5) TCE is considered carcinogenic by a mutagenic mode of action for induction of kidney tumors.
The adult-based oral SF for kidney cancer is 9.3×10^{-3} per mg/kg/day

(6) Oral SF listed is based on continuous lifetime exposure during adulthood.
The oral SF for the continuous lifetime exposure from birth is 1.5 per mg/kg/day.

(7) based on chromium (VI)

Definition:
Cal/EPA = California Environmental Protection Agency
EPA = United States Environmental Protection Agency
IRIS = Integrated Risk Information System
M = mutagen
mg/kg-day = milligram per kilogram per day
NA = not available
NJDEP = New Jersey Department of Environmental Protection
PPRTV = Provisional Peer Reviewed Toxicity Value

EPA Weight of Evidence (EPA 1986, EPA 1996):
A - Human carcinogen
B1 - Probable human carcinogen
indicates that limited human data are available
B2 - Probable human carcinogen - indicates sufficient evidence in
animals and inadequate or no evidence in humans
C - Possible human carcinogen
D - Not classifiable as human carcinogen

EPA Weight of Evidence Narrative (EPA 2005):
Carcinogenic to human
Likely to be carcinogenic to humans
Suggestive evidence of carcinogenic potential
Inadequate information to assess carcinogenic potential
Not likely to be carcinogenic to humans

TABLE B-6.2
CANCER TOXICITY DATA - INHALATION
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

Chemical of Potential Concern	Inhalation Unit Risk		Mutagen [1]	Weight of Evidence/ Cancer Guideline Description	Inhalation Unit Risk	
	Value	Unit			Source	Date [2]
Volatile Organic Compounds						
1,1,2,2-Tetrachloroethane	5.8E-05	$(\mu g/m^3)^{-1}$	--	Likely to be carcinogenic to humans	Cal/EPA	7/21/2009
1,1-Dichloroethane	1.6E-06	$(\mu g/m^3)^{-1}$	--	C	Cal/EPA	7/21/2009
1,2,3-Trichlorobenzene	NA	NA	--	NA	NA	NA
1,2-Dichloroethane	2.6E-05	$(\mu g/m^3)^{-1}$	--	B2	IRIS	11/12/2016
1,4-Dichlorobenzene	1.1E-05	$(\mu g/m^3)^{-1}$	--	2B	Cal/EPA	7/21/2009
Benzene	7.8E-06	$(\mu g/m^3)^{-1}$	--	A	IRIS	11/12/2016
Bromodichloromethane	3.7E-05	$(\mu g/m^3)^{-1}$	--	B2	Cal/EPA	6/1/2009
Chlorobenzene	NA	NA	--	D	IRIS	11/12/2016
Chloroform	2.3E-05	$(\mu g/m^3)^{-1}$	--	B2	IRIS	11/12/2016
cis-1,2-Dichloroethene	NA	NA	--	inadequate information to assess the carcinogenic potential	IRIS	11/12/2016
Trichloroethene[3]	4.1E-06	$(\mu g/m^3)^{-1}$	M	carcinogenic to humans	IRIS	11/12/2016
Vinyl Chloride[4]	4.4E-06	$(\mu g/m^3)^{-1}$	M	A	IRIS	11/12/2016
Semi-volatile Organic Compounds						
1,4-Dioxane	5.0E-06	$(\mu g/m^3)^{-1}$	--	Likely to be carcinogenic to humans	IRIS	11/12/2016
2,3,4,6-Tetrachlorophenol	NA	NA	--	NA	NA	NA
Benzo(a)anthracene	1.1E-04	$(\mu g/m^3)^{-1}$	M	B2	Cal/EPA	6/1/2009
Benzo(b)fluoranthene	1.1E-04	$(\mu g/m^3)^{-1}$	M	B2	Cal/EPA	6/1/2009
Bis(2-Ethylhexyl)Phthalate	2.4E-06	$(\mu g/m^3)^{-1}$	--	B2	Cal/EPA	7/29/2009
Naphthalene	3.4E-05	$(\mu g/m^3)^{-1}$		C	Cal/EPA	7/21/2009
Inorganics						
Antimony	NA	NA	--	NA	NA	NA
Chromium[5]	1.2E-02	$(\mu g/m^3)^{-1}$	--	A	IRIS	11/12/2016
Cobalt	9.0E-03	$(\mu g/m^3)^{-1}$	--	likely to be carcinogenic to humans	PPRTV	8/25/2008
Iron	NA	NA	--	inadequate information to assess the carcinogenic potential	PPRTV	9/11/2006
Lead	NA	NA	--	B2	IRIS	11/12/2016
Manganese	NA	NA	--	D	IRIS	11/12/2016
Nickel[6]	2.4E-04	$(\mu g/m^3)^{-1}$	--	A	IRIS	11/12/2016
Thallium	NA	NA	--	inadequate information to assess the carcinogenic potential	PPRTV	10/25/2012

TABLE B-6.2
CANCER TOXICITY DATA - INHALATION
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

(1) Identified as a mutagen on the Regional Screening Level (RSL) Table, May 2016, http://www.epa.gov/risk/risk-based-screening-table-generic-tables

(2) Date shown for IRIS is the date IRIS was searched. http://www.epa.gov/iris/ Date shown for other sources is the publication date.

(3) TCE is considered carcinogenic by a mutagenic mode of action for induction of kidney tumors. The adult-based IUR for kidney cancer is 1×10^{-6} per $\mu g/m^3$.

(4) IUR listed is based on continuous lifetime exposure during adulthood. The IUR for the continuous lifetime exposure from birth is 8.8×10^{-6} per $\mu g/m^3$.

(5) based on chromium (VI)

(6) weight of evidence is based on nickel refinery dust

Definition:
Cal/EPA = California Environmental Protection Agency
IRIS = Integrated Risk Information System
M = mutagen
NA = not available
$\mu g/m^3$ = microgram per cubic meter
PPRTV = Provisional Peer Reviewed Toxicity Value

EPA Weight of Evidence (EPA 1986, EPA 1996):
A - Human Carcinogen
B1 - Probable human carcinogen indicates that limited human data are available
B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans
C - Possible human carcinogen
D - Not classifiable as human carcinogen

EPA Weight of Evidence Narrative (EPA 2005):
Carcinogenic to human
Likely to be carcinogenic to humans
Suggestive evidence of carcinogenic potential
Inadequate information to assess carcinogenic potential
Not likely to be carcinogenic to humans

TABLE B-7.0

CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS - TRICHLOROETHYLENE

GROUNDWATER FOR CURRENT/FUTURE RESIDENT

REASONABLE MAXIMUM EXPOSURE

Mansfield Trail Dump Site, OU1

Byram Township, New Jersey

Common Exposure Parameters

Groundwater Concentration (CW)	184	µg/L	
Exposure Frequency	350	days	
Permeability Coefficient	0.012	cm/hr	(Table B-4.2)
Fraction Absorbed Water	1		(Table B-4.2)
Lag time	0.58	hr/day	(Table B-4.2)
Exposure Time - child	0.54	hr/day	(Table B-4.1a)
Exposure Time - adult	0.71	hr/day	(Table B-4.1a)

Ingestion

	Exposure Parameters					Cancer Risk Calculations						
C1	*C2*	*C3*	*C4*	*C5*	*C6*	*C7*	*C8*	*C9*	*C10*	*C11*	*C12*	*C13*
Unit	kg	L/day	mg/L	yr	-	$(mg/kg/d)^{-1}$	-	-	$(mg/kg/d)^{-1}$	$(mg/kg/d)^{-1}$	-	-
Equation	-	-	CW/1000	-	*(C5 / 70 yr x EF / 365 days)*	-	-	*(C3 x C4 x C6 x C7 x C8 / C2)*	-	*(C10 − C7)*	*(C3 x C4 x C6 x C11 / C2)*	*(C9 + C12)*
Age group	Body Weight	Ingestion Rate	Exposure Concentration	Age Group Duration	Duration Adjustment	Kidney Slope Factor	Kidney Cancer ADAF	**Kidney ADAF-Adjusted Partial Risk**	Kidney+NHL+ Liver Slope Factor	NHL+Liver Slope Factor	**NHL+Liver Partial Risk**	**Total Partial Risk**
0 to <2 years	15	0.78	0.184	2	2.7E-02	9.3E-03	10	**2.4E-05**	4.6E-02	3.7E-02	**9.6E-06**	**3.4E-05**
2 to <6 years	15	0.78	0.184	4	5.5E-02	9.3E-03	3	**1.5E-05**	4.6E-02	3.7E-02	**1.9E-05**	**3.4E-05**
6 to <16 years	80	2.5	0.184	10	1.4E-01	9.3E-03	3	**2.2E-05**	4.6E-02	3.7E-02	**2.9E-05**	**5.1E-05**
16 to <26 years	80	2.5	0.184	10	1.4E-01	9.3E-03	1	**7.3E-06**	4.6E-02	3.7E-02	**2.9E-05**	**3.6E-05**
											Total Ingestion Risk	**1.6E-04**

Dermal Contact

	Exposure Parameters					Cancer Risk Calculations						
C1	*C2*	*C3*	*C4*	*C5*	*C6*	*C7*	*C8*	*C9*	*C10*	*C11*	*C12*	*C13*
Unit	kg	cm^2/day	mg/cm^2	yr	-	$(mg/kg/d)^{-1}$	-	-	$(mg/kg/d)^{-1}$	$(mg/kg/d)^{-1}$	-	-
Equation	-	-	*Table B-4.5*	-	*(C5 / 70 yr x EF / 365 days)*	-	-	*(C3 x C4 x C6 x C7 x C8 / C2)*	-	*(C10 − C7)*	*(C3 x C4 x C6 x C11 / C2)*	*(C9 + C12)*
Age group	Body Weight	Skin Surface Area	Dermal Absorbed (DA_{event})	Age Group Duration	Duration Adjustment	Kidney Slope Factor	Kidney Cancer ADAF	**Kidney ADAF-Adjusted Partial Risk**	Kidney+NHL+ Liver Slope Factor	NHL+Liver Slope Factor	**NHL+Liver Partial Risk**	**Total Partial Risk**
0 to <2 years	15	6,378	3.4E-06	2	2.7E-02	9.3E-03	10	**3.7E-06**	4.6E-02	3.7E-02	**1.5E-06**	**5.2E-06**
2 to <6 years	15	6,378	3.4E-06	4	5.5E-02	9.3E-03	3	**2.2E-06**	4.6E-02	3.7E-02	**2.9E-06**	**5.1E-06**
6 to <16 years	80	20,900	3.9E-06	10	1.4E-01	9.3E-03	3	**3.9E-06**	4.6E-02	3.7E-02	**5.1E-06**	**9.1E-06**
16 to <26 years	80	20,900	3.9E-06	10	1.4E-01	9.3E-03	1	**1.3E-06**	4.6E-02	3.7E-02	**5.1E-06**	**6.5E-06**
											Total Dermal Risk	**2.6E-05**

TABLE B-7.0

CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS - TRICHLOROETHYLENE

GROUNDWATER FOR CURRENT/FUTURE RESIDENT

REASONABLE MAXIMUM EXPOSURE

Mansfield Trail Dump Site, OU1

Byram Township, New Jersey

Inhalation of Volatile Chemicals

	Exposure Parameters					Cancer Risk Calculations						
C1	*C2*	*C3*	*C4*	*C5*	*C6*	*C7*	*C8*	*C9*	*C10*	*C11*	*C12*	*C13*
Unit	hr/day	$\mu g/m^3$	$\mu g/m^3$	yr	-	$(\mu g/m^3)^{-1}$	-	-	$(\mu g/m^3)^{-1}$	$(\mu g/m^3)^{-1}$	-	-
Equation	-	Table D-3/D-4	*C3*	-	*(C5 / 70 yr x C2 / 24 hrs x EF / 365 days)*	-	-	*(C4 x C6 x C7 x C8)*	-	*(C10 − C7)*	*(C4 x C6 x C11)*	*(C9 + C12)*
Age group	Exposure Time	Chemical Concentration in Air	Exposure Concentration	Age Group Duration	Duration Adjustment	Kidney Unit Risk	Kidney Cancer ADAF	**Kidney ADAF-Adjusted Partial Risk**	Kidney+NHL+ Liver Unit Risk	NHL+Liver Unit Risk	**NHL+Liver Partial Risk**	**Total Partial Risk**
0 to <2 years	0.54	5.3E+03	5.3E+03	2	6.2E-04	1.0E-06	10	**3.3E-05**	4.1E-06	3.1E-06	**1.0E-05**	**4.3E-05**
2 to <6 years	0.54	5.3E+03	5.3E+03	4	1.2E-03	1.0E-06	3	**2.0E-05**	4.1E-06	3.1E-06	**2.0E-05**	**4.0E-05**
6 to <16 years	0.71	5.6E+03	5.6E+03	10	4.1E-03	1.0E-06	3	**6.9E-05**	4.1E-06	3.1E-06	**7.1E-05**	**1.4E-04**
16 to <26 years	0.71	5.6E+03	5.6E+03	10	4.1E-03	1.0E-06	1	**2.3E-05**	4.1E-06	3.1E-06	**7.1E-05**	**9.4E-05**
										Total Inhalation Risk		**3.2E-04**

ADAF = age-dependent adjustment factors

Source:
EPA 2011. Toxicological Review of Trichloroethylene (CAS No. 79-01-6) in Support of Summary Information on the Integrated Risk Information System (IRIS). September.

TABLE B-7.1
CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Resident
Receptor Age:	Child/Lifetime[1]

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	Exposure Point Concentration		Cancer Risk Calculation					Noncancer Hazard Calculation				
							Intake/ Exposure Concentration		Slope Factor/Unit Risk		Cancer	Intake/ Exposure Concentration		RfD/RfC		Hazard
					Value	Unit	Value	Unit	Value	Unit	Risk	Value	Unit	Value	Unit	Quotient
Groundwater	Groundwater	Tap Water	Ingestion	**Volatile Organic Compounds**												
				1,1,2,2-Tetrachloroethane	2.40E-01	µg/L	3.08E-06	mg/kg-day	2.0E-01	$(mg/kg-day)^{-1}$	6.16E-07	1.20E-05	mg/kg-day	2.0E-02	mg/kg-day	5.98E-04
				1,1-Dichloroethane	2.71E+01	µg/L	3.48E-04	mg/kg-day	5.7E-03	$(mg/kg-day)^{-1}$	1.98E-06	1.35E-03	mg/kg-day	2.0E-01	mg/kg-day	6.75E-03
				1,2,3-Trichlorobenzene	8.50E+00	µg/L	1.09E-04	mg/kg-day	NA	NA	NA	4.24E-04	mg/kg-day	8.0E-04	mg/kg-day	5.30E-01
				1,2-Dichloroethane	2.87E-01	µg/L	3.68E-06	mg/kg-day	9.1E-02	$(mg/kg-day)^{-1}$	3.35E-07	1.43E-05	mg/kg-day	6.0E-03	mg/kg-day	2.39E-03
				1,4-Dichlorobenzene	1.02E+01	µg/L	1.31E-04	mg/kg-day	5.4E-03	$(mg/kg-day)^{-1}$	7.06E-07	5.08E-04	mg/kg-day	7.0E-02	mg/kg-day	7.25E-03
				Benzene	8.15E-01	µg/L	1.05E-05	mg/kg-day	5.5E-02	$(mg/kg-day)^{-1}$	5.75E-07	4.06E-05	mg/kg-day	4.0E-03	mg/kg-day	1.02E-02
				Bromodichloromethane	4.69E-01	µg/L	6.02E-06	mg/kg-day	6.2E-02	$(mg/kg-day)^{-1}$	3.73E-07	2.34E-05	mg/kg-day	2.0E-02	mg/kg-day	1.17E-03
				Chlorobenzene	3.15E+01	µg/L	4.05E-04	mg/kg-day	NA	NA	NA	1.57E-03	mg/kg-day	2.0E-02	mg/kg-day	7.86E-02
				Chloroform	3.33E+00	µg/L	4.27E-05	mg/kg-day	3.1E-02	$(mg/kg-day)^{-1}$	1.32E-06	1.66E-04	mg/kg-day	1.0E-02	mg/kg-day	1.66E-02
				cis-1,2-Dichloroethene	5.31E+01	µg/L	6.81E-04	mg/kg-day	NA	NA	NA	2.65E-03	mg/kg-day	2.0E-03	mg/kg-day	1.32E+00
				Trichloroethene	1.84E+02	µg/L	See Table B-7.0.9	NA	4.6E-02	NA	1.55E-04	9.18E-03	mg/kg-day	5.0E-04	mg/kg-day	1.84E+01
				Vinyl Chloride	1.97E+01	µg/L	1.28E-03	mg/kg-day	7.2E-01	$(mg/kg-day)^{-1}$	9.21E-04	9.84E-04	mg/kg-day	3.0E-03	mg/kg-day	3.28E-01
				Semi-volatile Organic Compounds												
				1,4-Dioxane	2.16E+01	µg/L	2.77E-04	mg/kg-day	1.0E-01	$(mg/kg-day)^{-1}$	2.77E-05	1.07E-03	mg/kg-day	3.0E-02	mg/kg-day	3.58E-02
				2,3,4,6-Tetrachlorophenol	1.10E+02	µg/L	1.41E-03	mg/kg-day	NA	NA	NA	5.48E-03	mg/kg-day	3.0E-02	mg/kg-day	1.83E-01
				Benzo(a)anthracene	3.50E-02	µg/L	1.40E-06	mg/kg-day	7.3E-01	$(mg/kg-day)^{-1}$	1.02E-06	1.75E-06	mg/kg-day	NA	NA	NA
				Benzo(b)fluoranthene	1.50E-01	µg/L	5.99E-06	mg/kg-day	7.3E-01	$(mg/kg-day)^{-1}$	4.37E-06	7.48E-06	mg/kg-day	NA	NA	NA
				Bis(2-Ethylhexyl)Phthalate	6.05E+00	µg/L	7.76E-05	mg/kg-day	1.4E-02	$(mg/kg-day)^{-1}$	1.09E-06	3.01E-04	mg/kg-day	2.0E-02	mg/kg-day	1.51E-02
				Naphthalene	1.28E-01	µg/L	1.64E-06	mg/kg-day	NA	NA	NA	6.38E-06	mg/kg-day	2.0E-02	mg/kg-day	3.19E-04
				Inorganics												
				Antimony	5.20E+00	µg/L	6.67E-05	mg/kg-day	NA	NA	NA	2.59E-04	mg/kg-day	4.0E-04	mg/kg-day	6.48E-01
				Chromium	6.22E+02	µg/L	7.98E-03	mg/kg-day	5.0E-01	$(mg/kg-day)^{-1}$	3.99E-03	3.10E-02	mg/kg-day	3.0E-03	mg/kg-day	1.03E+01
				Cobalt	1.42E+01	µg/L	1.82E-04	mg/kg-day	NA	NA	NA	7.06E-04	mg/kg-day	3.0E-04	mg/kg-day	2.35E+00
				Iron	2.13E+04	µg/L	2.73E-01	mg/kg-day	NA	NA	NA	1.06E+00	mg/kg-day	7.0E-01	mg/kg-day	1.52E+00
				Lead	1.02E+01	µg/L	1.30E-04	mg/kg-day	NA	NA	NA	5.06E-04	mg/kg-day	NA	NA	NA
				Manganese	3.90E+03	µg/L	5.01E-02	mg/kg-day	NA	NA	NA	1.95E-01	mg/kg-day	1.4E-01	mg/kg-day	1.39E+00
				Nickel	1.26E+03	µg/L	1.62E-02	mg/kg-day	NA	NA	NA	6.28E-02	mg/kg-day	2.0E-02	mg/kg-day	3.14E+00
				Thallium	6.30E-02	µg/L	8.09E-07	mg/kg-day	NA	NA	NA	3.14E-06	mg/kg-day	1.0E-05	mg/kg-day	3.14E-01
			Exp. Route Total								5.11E-03					4.06E+01
Groundwater	Groundwater	Tap Water	Dermal Contact	**Volatile Organic Compounds**												
				1,1,2,2-Tetrachloroethane	2.40E-01	µg/L	3.85E-07	mg/kg-day	2.0E-01	$(mg/kg-day)^{-1}$	7.70E-08	1.47E-06	mg/kg-day	2.0E-02	mg/kg-day	7.37E-05
				1,1-Dichloroethane	2.71E+01	µg/L	2.70E-05	mg/kg-day	5.7E-03	$(mg/kg-day)^{-1}$	1.54E-07	1.03E-04	mg/kg-day	2.0E-01	mg/kg-day	5.16E-04
				1,2,3-Trichlorobenzene	8.50E+00	µg/L	NA	NA	NA	NA	NA	NA	NA	8.0E-04	mg/kg-day	NA
				1,2-Dichloroethane	2.87E-01	µg/L	1.79E-07	mg/kg-day	9.1E-02	$(mg/kg-day)^{-1}$	1.63E-08	6.86E-07	mg/kg-day	6.0E-03	mg/kg-day	1.14E-04
				1,4-Dichlorobenzene	1.02E+01	µg/L	8.69E-05	mg/kg-day	5.4E-03	$(mg/kg-day)^{-1}$	4.69E-07	3.33E-04	mg/kg-day	7.0E-02	mg/kg-day	4.75E-03
				Benzene	8.15E-01	µg/L	1.59E-06	mg/kg-day	5.5E-02	$(mg/kg-day)^{-1}$	8.73E-08	6.08E-06	mg/kg-day	4.0E-03	mg/kg-day	1.52E-03
				Bromodichloromethane	4.69E-01	µg/L	4.88E-07	mg/kg-day	6.2E-02	$(mg/kg-day)^{-1}$	3.03E-08	1.87E-06	mg/kg-day	2.0E-02	mg/kg-day	9.34E-05
				Chlorobenzene	3.15E+01	µg/L	1.44E-04	mg/kg-day	NA	NA	NA	5.53E-04	mg/kg-day	2.0E-02	mg/kg-day	2.76E-02
				Chloroform	3.33E+00	µg/L	3.86E-06	mg/kg-day	3.1E-02	$(mg/kg-day)^{-1}$	1.20E-07	1.48E-05	mg/kg-day	1.0E-02	mg/kg-day	1.48E-03
				cis-1,2-Dichloroethene	5.31E+01	µg/L	NA	NA	NA	NA	NA	NA	NA	2.0E-03	mg/kg-day	NA
				Trichloroethene	1.84E+02	µg/L	See Table B-7.0.9	NA	4.6E-02	$(mg/kg-day)^{-1}$	2.58E-05	1.55E-03	mg/kg-day	5.0E-04	mg/kg-day	3.11E+00
				Vinyl Chloride	1.97E+01	µg/L	6.76E-05	mg/kg-day	7.2E-01	$(mg/kg-day)^{-1}$	4.87E-05	5.19E-05	mg/kg-day	3.0E-03	mg/kg-day	1.73E-02
				Semi-volatile Organic Compounds												
				1,4-Dioxane	2.16E+01	µg/L	9.85E-07	mg/kg-day	1.0E-01	$(mg/kg-day)^{-1}$	9.85E-08	3.77E-06	mg/kg-day	3.0E-02	mg/kg-day	1.26E-04

TABLE B-7.1
CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Resident
Receptor Age:	Child/Lifetime[1]

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	Exposure Point Concentration		Cancer Risk Calculation					Noncancer Hazard Calculation				
							Intake/ Exposure Concentration		Slope Factor/Unit Risk		Cancer	Intake/ Exposure Concentration		RfD/RfC		Hazard
					Value	Unit	Value	Unit	Value	Unit	Risk	Value	Unit	Value	Unit	Quotient
				2,3,4,6-Tetrachlorophenol	1.10E+02	µg/L	NA	NA	NA	NA	NA	NA	NA	3.0E-02	mg/kg-day	NA
				Benzo(a)anthracene	3.50E-02	µg/L	1.75E-05	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	1.28E-05	2.16E-05	mg/kg-day	NA	NA	NA
				Benzo(b)fluoranthene	1.50E-01	µg/L	1.30E-04	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	9.52E-05	1.61E-04	mg/kg-day	NA	NA	NA
				Bis(2-Ethylhexyl)Phthalate	6.05E+00	µg/L	1.19E-04	mg/kg-day	1.4E-02	$(mg/kg\text{-}day)^{-1}$	1.66E-06	4.55E-04	mg/kg-day	2.0E-02	mg/kg-day	2.28E-02
				Naphthalene	1.28E-01	µg/L	1.09E-06	mg/kg-day	NA	NA	NA	4.16E-06	mg/kg-day	2.0E-02	mg/kg-day	2.08E-04
				Inorganics												
				Antimony	5.20E+00	µg/L	3.72E-07	mg/kg-day	NA	NA	NA	1.42E-06	mg/kg-day	6.0E-05	mg/kg-day	2.37E-02
				Chromium	6.22E+02	µg/L	8.89E-05	mg/kg-day	2.0E+01		1.78E-03	3.40E-04	mg/kg-day	7.5E-05	mg/kg-day	4.54E+00
				Cobalt	1.42E+01	µg/L	4.04E-07	mg/kg-day	NA	NA	NA	1.55E-06	mg/kg-day	3.0E-04	mg/kg-day	5.16E-03
				Iron	2.13E+04	µg/L	1.52E-03	mg/kg-day	NA		NA	5.83E-03	mg/kg-day	7.0E-01	mg/kg-day	8.32E-03
				Lead	1.02E+01	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	3.90E+03	µg/L	2.79E-04	mg/kg-day	NA	NA	NA	1.07E-03	mg/kg-day	1.4E-01	mg/kg-day	7.63E-03
				Nickel	1.26E+03	µg/L	1.80E-05	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NA	6.89E-05	mg/kg-day	8.0E-04	mg/kg-day	8.61E-02
				Thallium	6.30E-02	µg/L	4.50E-09	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NA	1.72E-08	mg/kg-day	1.0E-05	mg/kg-day	1.72E-03
			Exp. Route Total								1.96E-03					7.85E+00
Groundwater	Groundwater	Tap Water	Inhalation	**Volatile Organic Compounds**												
				1,1,2,2-Tetrachloroethane	2.40E-01	µg/L	6.79E-02	$µg/m^3$	5.8E-05	$(µg/m^3)^{-1}$	3.94E-06	1.40E-04	mg/m^3	NA	mg/m^3	NA
				1,1-Dichloroethane	2.71E+01	µg/L	8.38E+00	$µg/m^3$	1.6E-06	$(µg/m^3)^{-1}$	1.34E-05	1.73E-02	mg/m^3	NA	NA	NA
				1,2,3-Trichlorobenzene	8.50E+00	µg/L	2.25E+00	$µg/m^3$	NA	NA	NA	4.63E-03	mg/m^3	NA	NA	NA
				1,2-Dichloroethane	2.87E-01	µg/L	9.10E-02	$µg/m^3$	2.6E-05	$(µg/m^3)^{-1}$	2.37E-06	1.88E-04	mg/m^3	7.0E-03	mg/m^3	2.68E-02
				1,4-Dichlorobenzene	1.02E+01	µg/L	2.75E+00	$µg/m^3$	1.1E-05	$(µg/m^3)^{-1}$	3.03E-05	5.68E-03	mg/m^3	8.0E-01	mg/m^3	7.10E-03
				Benzene	8.15E-01	µg/L	2.47E-01	$µg/m^3$	7.8E-06	$(µg/m^3)^{-1}$	1.93E-06	5.10E-04	mg/m^3	3.0E-02	mg/m^3	1.70E-02
				Bromodichloromethane	4.69E-01	µg/L	1.46E-01	$µg/m^3$	3.7E-05	$(µg/m^3)^{-1}$	5.40E-06	3.01E-04	mg/m^3	NA	NA	NA
				Chlorobenzene	3.15E+01	µg/L	9.05E+00	$µg/m^3$	NA	NA	NA	1.87E-02	mg/m^3	5.0E-02	mg/m^3	3.73E-01
				Chloroform	3.33E+00	µg/L	1.05E+00	$µg/m^3$	2.3E-05	$(µg/m^3)^{-1}$	2.41E-05	2.16E-03	mg/m^3	3.0E-01	mg/m^3	7.20E-03
				cis-1,2-Dichloroethene	5.31E+01	µg/L	1.71E+01	$µg/m^3$	NA	NA	NA	3.53E-02	mg/m^3	NA	NA	NA
				Trichloroethene	1.84E+02	µg/L	See Table B-7.0.9	NA	4.1E-06	$(µg/m^3)^{-1}$	3.16E-04	1.14E-01	mg/m^3	2.0E-03	mg/m^3	5.72E+01
				Vinyl Chloride	1.97E+01	µg/L	6.41E+02	$µg/m^3$	4.4E-06	$(µg/m^3)^{-1}$	2.82E-03	1.37E-02	mg/m^3	1.0E-01	mg/m^3	1.37E-01
			Exp. Route Total								3.22E-03					5.78E+01
		Exposure Point Total									1.03E-02					1.06E+02

[1] Noncancer hazards presented for the child receptor (birth to <6 years); cancer risks presented for the lifetime receptor.

RfD = reference dose
NA = not applicable

mg/kg = milligram per kilogram
mg/kg-day = milligram per kilogram per day

$µg/m^3$ = microgram per cubic meter
mg/m^3 = milligram per cubic meter

TABLE B-7.2
CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

Scenario Timeframe:	Future
Receptor Population:	Resident
Receptor Age:	Adult/Lifetime[1]

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	Exposure Point Concentration		Cancer Risk Calculation					Adult Noncancer Hazard Calculation				
							Intake/ Exposure Concentration		Slope Factor/Unit Risk		Cancer	Intake/ Exposure Concentration		RfD/RfC		Hazard
					Value	Unit	Value	Unit	Value	Unit	Risk	Value	Unit	Value	Unit	Quotient
Groundwater	Groundwater	Tap Water	Ingestion	**Volatile Organic Compounds**												
				1,1,2,2-Tetrachloroethane	2.40E-01	µg/L	3.08E-06	mg/kg-day	2.0E-01	$(mg/kg-day)^{-1}$	6.16E-07	7.19E-06	mg/kg-day	2.0E-02	mg/kg-day	3.60E-04
				1,1-Dichloroethane	2.71E+01	µg/L	3.48E-04	mg/kg-day	5.7E-03	$(mg/kg-day)^{-1}$	1.98E-06	8.12E-04	mg/kg-day	2.0E-01	mg/kg-day	4.06E-03
				1,2,3-Trichlorobenzene	8.50E+00	µg/L	1.09E-04	mg/kg-day	NA	NA	NA	2.55E-04	mg/kg-day	8.0E-04	mg/kg-day	3.18E-01
				1,2-Dichloroethane	2.87E-01	µg/L	3.68E-06	mg/kg-day	9.1E-02	$(mg/kg-day)^{-1}$	3.35E-07	8.60E-06	mg/kg-day	6.0E-03	mg/kg-day	1.43E-03
				1,4-Dichlorobenzene	1.02E+01	µg/L	1.31E-04	mg/kg-day	5.4E-03	$(mg/kg-day)^{-1}$	7.06E-07	3.05E-04	mg/kg-day	7.0E-02	mg/kg-day	4.36E-03
				Benzene	8.15E-01	µg/L	1.05E-05	mg/kg-day	5.5E-02	$(mg/kg-day)^{-1}$	5.75E-07	2.44E-05	mg/kg-day	4.0E-03	mg/kg-day	6.11E-03
				Bromodichloromethane	4.69E-01	µg/L	6.02E-06	mg/kg-day	6.2E-02	$(mg/kg-day)^{-1}$	3.73E-07	1.41E-05	mg/kg-day	2.0E-02	mg/kg-day	7.03E-04
				Chlorobenzene	3.15E+01	µg/L	4.05E-04	mg/kg-day	NA	NA	NA	9.45E-04	mg/kg-day	2.0E-02	mg/kg-day	4.73E-02
				Chloroform	3.33E+00	µg/L	4.27E-05	mg/kg-day	3.1E-02	$(mg/kg-day)^{-1}$	1.32E-06	9.97E-05	mg/kg-day	1.0E-02	mg/kg-day	9.97E-03
				cis-1,2-Dichloroethene	5.31E+01	µg/L	6.81E-04	mg/kg-day	NA	NA	NA	1.59E-03	mg/kg-day	2.0E-03	mg/kg-day	7.95E-01
				Trichloroethene	1.84E+02	µg/L	See Table B-7.0.9	NA	4.6E-02	$(mg/kg-day)^{-1}$	1.55E-04	5.52E-03	mg/kg-day	5.0E-04	mg/kg-day	1.10E+01
				Vinyl Chloride	1.97E+01	µg/L	1.28E-03	mg/kg-day	7.2E-01	$(mg/kg-day)^{-1}$	9.21E-04	5.92E-04	mg/kg-day	3.0E-03	mg/kg-day	1.97E-01
				Semi-volatile Organic Compounds												
				1,4-Dioxane	2.16E+01	µg/L	2.77E-04	mg/kg-day	1.0E-01	$(mg/kg-day)^{-1}$	2.77E-05	6.46E-04	mg/kg-day	3.0E-02	mg/kg-day	2.15E-02
				2,3,4,6-Tetrachlorophenol	1.10E+02	µg/L	1.41E-03	mg/kg-day	NA	NA	NA	3.30E-03	mg/kg-day	3.0E-02	mg/kg-day	1.10E-01
				Benzo(a)anthracene	3.50E-02	µg/L	1.40E-06	mg/kg-day	7.3E-01	$(mg/kg-day)^{-1}$	1.02E-06	1.05E-06	mg/kg-day	NA	NA	NA
				Benzo(b)fluoranthene	1.50E-01	µg/L	5.99E-06	mg/kg-day	7.3E-01	$(mg/kg-day)^{-1}$	4.37E-06	4.49E-06	mg/kg-day	NA	NA	NA
				Bis(2-Ethylhexyl)Phthalate	6.05E+00	µg/L	7.76E-05	mg/kg-day	1.4E-02	$(mg/kg-day)^{-1}$	1.09E-06	1.81E-04	mg/kg-day	2.0E-02	mg/kg-day	9.06E-03
				Naphthalene	1.28E-01	µg/L	1.64E-06	mg/kg-day	NA	NA	NA	3.84E-06	mg/kg-day	2.0E-02	mg/kg-day	1.92E-04
				Inorganics												
				Antimony	5.20E+00	µg/L	6.67E-05	mg/kg-day	NA	NA	NA	1.56E-04	mg/kg-day	4.0E-04	mg/kg-day	3.90E-01
				Chromium	6.22E+02	µg/L	7.98E-03	mg/kg-day	5.0E-01	$(mg/kg-day)^{-1}$	3.99E-03	1.86E-02	mg/kg-day	3.0E-03	mg/kg-day	6.21E+00
				Cobalt	1.42E+01	µg/L	1.82E-04	mg/kg-day	NA	NA	NA	4.24E-04	mg/kg-day	3.0E-04	mg/kg-day	1.41E+00
				Iron	2.13E+04	µg/L	2.73E-01	mg/kg-day	NA	NA	NA	6.38E-01	mg/kg-day	7.0E-01	mg/kg-day	9.12E-01
				Lead	1.02E+01	µg/L	1.30E-04	mg/kg-day	NA	NA	NA	3.04E-04	mg/kg-day	NA	NA	NA
				Manganese	3.90E+03	µg/L	5.01E-02	mg/kg-day	NA	NA	NA	1.17E-01	mg/kg-day	1.4E-01	mg/kg-day	8.36E-01
				Nickel	1.26E+03	µg/L	1.62E-02	mg/kg-day	NA	NA	NA	3.78E-02	mg/kg-day	2.0E-02	mg/kg-day	1.89E+00
				Thallium	6.30E-02	µg/L	8.09E-07	mg/kg-day	NA	NA	NA	1.89E-06	mg/kg-day	1.0E-05	mg/kg-day	1.89E-01
			Exp. Route Total								5.11E-03					2.42E+01
Groundwater	Groundwater	Groundwater	Dermal	**Volatile Organic Compounds**												
			Contact	1,1,2,2-Tetrachloroethane	2.40E-01	µg/L	3.85E-07	mg/kg-day	2.0E-01	$(mg/kg-day)^{-1}$	7.70E-08	9.06E-07	mg/kg-day	2.0E-02	mg/kg-day	4.53E-05
				1,1-Dichloroethane	2.71E+01	µg/L	2.70E-05	mg/kg-day	5.7E-03	$(mg/kg-day)^{-1}$	1.54E-07	6.34E-05	mg/kg-day	2.0E-01	mg/kg-day	3.17E-04
				1,2,3-Trichlorobenzene	8.50E+00	µg/L	NA	NA	NA	NA	NA	NA	NA	8.0E-04	mg/kg-day	NA
				1,2-Dichloroethane	2.87E-01	µg/L	1.79E-07	mg/kg-day	9.1E-02	$(mg/kg-day)^{-1}$	1.63E-08	4.21E-07	mg/kg-day	6.0E-03	mg/kg-day	7.02E-05
				1,4-Dichlorobenzene	1.02E+01	µg/L	8.69E-05	mg/kg-day	5.4E-03	$(mg/kg-day)^{-1}$	4.69E-07	2.04E-04	mg/kg-day	7.0E-02	mg/kg-day	2.92E-03
				Benzene	8.15E-01	µg/L	1.59E-06	mg/kg-day	5.5E-02	$(mg/kg-day)^{-1}$	8.73E-08	3.73E-06	mg/kg-day	4.0E-03	mg/kg-day	9.33E-04
				Bromodichloromethane	4.69E-01	µg/L	4.88E-07	mg/kg-day	6.2E-02	$(mg/kg-day)^{-1}$	3.03E-08	1.15E-06	mg/kg-day	2.0E-02	mg/kg-day	5.74E-05
				Chlorobenzene	3.15E+01	µg/L	1.44E-04	mg/kg-day	NA	NA	NA	3.40E-04	mg/kg-day	2.0E-02	mg/kg-day	1.70E-02
				Chloroform	3.33E+00	µg/L	3.86E-06	mg/kg-day	3.1E-02	$(mg/kg-day)^{-1}$	1.20E-07	9.07E-06	mg/kg-day	1.0E-02	mg/kg-day	9.07E-04
				cis-1,2-Dichloroethene	5.31E+01	µg/L	NA	NA	NA	NA	NA	NA	NA	2.0E-03	mg/kg-day	NA
				Trichloroethene	1.84E+02	µg/L	See Table B-7.0.9	NA	4.6E-02	$(mg/kg-day)^{-1}$	2.58E-05	9.55E-04	mg/kg-day	5.0E-04	mg/kg-day	1.91E+00
				Vinyl Chloride	1.97E+01	µg/L	6.76E-05	mg/kg-day	7.2E-01	$(mg/kg-day)^{-1}$	4.87E-05	3.19E-05	mg/kg-day	3.0E-03	mg/kg-day	1.06E-02
				Semi-volatile Organic Compounds												
				1,4-Dioxane	2.16E+01	µg/L	9.85E-07	mg/kg-day	1.0E-01	$(mg/kg-day)^{-1}$	9.85E-08	2.32E-06	mg/kg-day	3.0E-02	mg/kg-day	7.72E-05
				2,3,4,6-Tetrachlorophenol	1.10E+02	µg/L	NA	NA	NA	NA	NA	NA	NA	3.0E-02	mg/kg-day	NA
				Benzo(a)anthracene	3.50E-02	µg/L	1.75E-05	mg/kg-day	7.3E-01	$(mg/kg-day)^{-1}$	1.28E-05	1.33E-05	mg/kg-day	NA	NA	NA
				Benzo(b)fluoranthene	1.50E-01	µg/L	1.30E-04	mg/kg-day	7.3E-01	$(mg/kg-day)^{-1}$	9.52E-05	9.91E-05	mg/kg-day	NA	NA	NA

TABLE B-7.2
CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

Scenario Timeframe:	Future
Receptor Population:	Resident
Receptor Age:	Adult/Lifetime[1]

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	Exposure Point Concentration		Cancer Risk Calculation					Adult Noncancer Hazard Calculation				
							Intake/ Exposure Concentration		Slope Factor/Unit Risk		Cancer	Intake/ Exposure Concentration		RfD/RfC		Hazard
					Value	Unit	Value	Unit	Value	Unit	Risk	Value	Unit	Value	Unit	Quotient
				Bis(2-Ethylhexyl)Phthalate	6.05E+00	µg/L	1.19E-04	mg/kg-day	1.4E-02	$(mg/kg\text{-}day)^{-1}$	1.66E-06	2.80E-04	mg/kg-day	2.0E-02	mg/kg-day	1.40E-02
				Naphthalene	1.28E-01	µg/L	1.09E-06	mg/kg-day	NA	NA	NA	2.55E-06	mg/kg-day	2.0E-02	mg/kg-day	1.28E-04
				Inorganics												
				Antimony	5.20E+00	µg/L	3.72E-07	mg/kg-day	NA	NA	NA	8.74E-07	mg/kg-day	6.0E-05	mg/kg-day	1.46E-02
				Chromium	6.22E+02	µg/L	8.89E-05	mg/kg-day	2.0E+01	$(mg/kg\text{-}day)^{-1}$	1.78E-03	2.09E-04	mg/kg-day	7.5E-05	mg/kg-day	2.79E+00
				Cobalt	1.42E+01	µg/L	4.04E-07	mg/kg-day	NA	NA	NA	9.51E-07	mg/kg-day	3.0E-04	mg/kg-day	3.17E-03
				Iron	2.13E+04	µg/L	1.52E-03	mg/kg-day	NA	NA	NA	3.58E-03	mg/kg-day	7.0E-01	mg/kg-day	5.11E-03
				Lead	1.02E+01	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	3.90E+03	µg/L	2.79E-04	mg/kg-day	NA	NA	NA	6.56E-04	mg/kg-day	1.4E-01	mg/kg-day	4.69E-03
				Nickel	1.26E+03	µg/L	1.80E-05	mg/kg-day	NA	NA	NA	4.23E-05	mg/kg-day	8.0E-04	mg/kg-day	5.29E-02
				Thallium	6.30E-02	µg/L	4.50E-09	mg/kg-day	NA	NA	NA	1.06E-08	mg/kg-day	1.0E-05	mg/kg-day	1.06E-03
			Exp. Route Total								1.96E-03					4.82E+00
Groundwater	Groundwater	Groundwater	Inhalation	**Volatile Organic Compounds**												
				1,1,2,2-Tetrachloroethane	2.40E-01	µg/L	6.79E-02	$µg/m^3$	5.8E-05	$(µg/m^3)^{-1}$	3.94E-06	1.96E-04	mg/m^3	NA	NA	NA
				1,1-Dichloroethane	2.71E+01	µg/L	8.38E+00	$µg/m^3$	1.6E-06	$(µg/m^3)^{-1}$	1.34E-05	2.41E-02	mg/m^3	NA	NA	NA
				1,2,3-Trichlorobenzene	8.50E+00	µg/L	2.25E+00	$µg/m^3$	NA	NA	NA	6.47E-03	mg/m^3	NA	NA	NA
				1,2-Dichloroethane	2.87E-01	µg/L	9.10E-02	$µg/m^3$	2.6E-05	$(µg/m^3)^{-1}$	2.37E-06	2.62E-04	mg/m^3	7.0E-03	mg/m^3	3.75E-02
				1,4-Dichlorobenzene	1.02E+01	µg/L	2.75E+00	$µg/m^3$	1.1E-05	$(µg/m^3)^{-1}$	3.03E-05	7.93E-03	mg/m^3	8.0E-01	mg/m^3	9.92E-03
				Benzene	8.15E-01	µg/L	2.47E-01	$µg/m^3$	7.8E-06	$(µg/m^3)^{-1}$	1.93E-06	7.12E-04	mg/m^3	3.0E-02	mg/m^3	2.37E-02
				Bromodichloromethane	4.69E-01	µg/L	1.46E-01	$µg/m^3$	3.7E-05	$(µg/m^3)^{-1}$	5.40E-06	4.21E-04	mg/m^3	NA	NA	NA
				Chlorobenzene	3.15E+01	µg/L	9.05E+00	$µg/m^3$	NA	NA	NA	2.61E-02	mg/m^3	5.0E-02	mg/m^3	5.21E-01
				Chloroform	3.33E+00	µg/L	1.05E+00	$µg/m^3$	2.3E-05	$(µg/m^3)^{-1}$	2.41E-05	3.02E-03	mg/m^3	3.0E-01	mg/m^3	1.01E-02
				cis-1,2-Dichloroethene	5.31E+01	µg/L	1.71E+01	$µg/m^3$	NA	NA	NA	4.94E-02	mg/m^3	NA	NA	NA
				Trichloroethene	1.84E+02	µg/L	See Table B-7.0.9	NA	4.1E-06	$(µg/m^3)^{-1}$	3.16E-04	1.60E-01	mg/m^3	2.0E-03	mg/m^3	8.00E+01
				Vinyl Chloride	1.97E+01	µg/L	6.41E+02	$µg/m^3$	4.4E-06	$(µg/m^3)^{-1}$	2.82E-03	1.91E-02	mg/m^3	1.0E-01	mg/m^3	1.91E-01
			Exp. Route Total								3.22E-03					8.08E+01
		Exposure Point Total									1.03E-02					1.10E+02

[1] Noncancer hazards presented for the adult receptor; cancer risks presented for the lifetime receptor.

RfD = reference dose
NA = not applicable
mg/kg = milligram per kilogram
mg/kg-day = milligram per kilogram per day
$µg/m^3$ = microgram per cubic meter
mg/m^3 = milligram per cubic meter

TABLE B-8
CALCULATION OF RADIATION CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

Scenario Timeframe:	NA
Receptor Population:	NA
Receptor Age:	NA

Medium	Exposure Medium	Exposure Point	Exposure Route	Radionuclide of Potential Concern	Exposure Point Concentration		Risk Calculation Approach	Cancer Risk Calculation				
								Intake/Activity		Cancer Slope Factor		
					Value	Unit		Value	Unit	Value	Unit	Cancer Risk
NOT APPLICABLE TO THIS SITE												
			Exp. Route Total									
		Exposure Point Total										
												Total of Receptor Risks Across All Media

There are no radionucleotides in this risk assessment. As a result, this table is blank

TABLE B-9.1
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Resident
Receptor Age:	Child/Lifetime[1]

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Groundwater	Groundwater	Tap Water	**Volatile Organic Compounds**									
			1,1,2,2-Tetrachloroethane	6E-07	8E-08	4E-06	5E-06	Liver	6E-04	7E-05	NA	7E-04
			1,1-Dichloroethane	2E-06	2E-07	1E-05	2E-05	Kidney	7E-03	5E-04	NA	7E-03
			1,2,3-Trichlorobenzene	NA	NA	NA	NA	Body Weight/Liver/Thyroid	5E-01	NA	NA	5E-01
			1,2-Dichloroethane	3E-07	2E-08	2E-06	3E-06	Liver/Kidney	2E-03	1E-04	3E-02	3E-02
			1,4-Dichlorobenzene	7E-07	5E-07	3E-05	3E-05	Liver	7E-03	5E-03	7E-03	2E-02
			Benzene	6E-07	9E-08	2E-06	3E-06	Blood	1E-02	2E-03	2E-02	3E-02
			Bromodichloromethane	4E-07	3E-08	5E-06	6E-06	Liver	1E-03	9E-05	NA	1E-03
			Chlorobenzene	NA	NA	NA	NA	Liver/Kidney	8E-02	3E-02	4E-01	5E-01
			Chloroform	1E-06	1E-07	2E-05	3E-05	Liver/Alimentary System/ Kidney/Developmental	2E-02	1E-03	7E-03	3E-02
			cis-1,2-Dichloroethene	NA	NA	NA	NA	Kidney	1E+00	NA	NA	1E+00
			Trichloroethene	2E-04	3E-05	3E-04	5E-04	Heart/ Immune System/ Developmental/Kidney/Liver	2E+01	3E+00	6E+01	8E+01
			Vinyl Chloride	9E-04	5E-05	3E-03	4E-03	Liver	3E-01	2E-02	1E-01	5E-01
			Semi-volatile Organic Compounds									
			1,4-Dioxane	3E-05	1E-07	NA	3E-05	Liver/Kidney/CNS/Respiratory System	4E-02	1E-04	NA	4E-02
			2,3,4,6-Tetrachlorophenol	NA	NA	NA	NA	Liver	2E-01	NA	NA	2E-01
			Benzo(a)anthracene	1E-06	1E-05	NA	1E-05	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	4E-06	1E-04	NA	1E-04	NA	NA	NA	NA	NA
			Bis(2-Ethylhexyl)Phthalate	1E-06	2E-06	NA	3E-06	Liver	2E-02	2E-02	NA	4E-02
			Naphthalene	NA	NA	NA	NA	Body Weight/CNS/Respiratory System	3E-04	2E-04	NA	5E-04
			Inorganics									
			Antimony	NA	NA	NA	NA	Longevity/Blood/Lung	6E-01	2E-02	NA	7E-01
			Chromium	4E-03	2E-03	NA	6E-03	Lung	1E+01	5E+00	NA	1E+01
			Cobalt	NA	NA	NA	NA	Thyroid/Respiratory System/ Lung	2E+00	5E-03	NA	2E+00
			Iron	NA	NA	NA	NA	GI Tract	2E+00	8E-03	NA	2E+00
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	CNS	1E+00	8E-03	NA	1E+00
			Nickel	NA	NA	NA	NA	Body and Organ Weight/Respiratory System	3E+00	9E-02	NA	3E+00
			Thallium	NA	NA	NA	NA	Skin/Hair	3E-01	2E-03	NA	3E-01
			Chemical Total	5E-03	2E-03	3E-03	1E-02	Chemical Total	4E+01	8E+00	6E+01	1E+02
		Exposure Point Total					1E-02					1E+02
	Exposure Medium Total						1E-02					1E+02
Medium Total							1E-02					1E+02
Receptor Total							1E-02					1E+02

TABLE B-9.1
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Resident
Receptor Age:	Child/Lifetime[1]

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total

Total Excess Cancer Risk Across All Media	1E-02
Total Hazard Index (HI) Across All Media	106

[1] Noncancer hazards presented for the child receptor (birth to <6 years); cancer risks presented for the lifetime receptor.

Alimentary System HI Across All Media =	0.03
Blood HI Across All Media =	0.7
Body and Organ Weight HI Across All Media =	3
Body weight HI Across All Media =	0.5
CNS HI Across All Media =	1
Development HI Across All Media =	79
GI Tract HI Across All Media =	2
Hair HI Across All Media =	0.3
Heart HI Across All Media =	79
Immune system HI Across All Media =	79
Kidney HI Across All Media =	81
Liver HI Across All Media =	81
Longevity HI Across All Media =	0.7
Lung HI Across All Media =	18
Respiratory System HI Across All Media =	6
Skin HI Across All Media =	0.3
Thyroid HI Across All Media =	3

NA = not applicable CNS = central nervous system GI = gastrointestinal

TABLE B-9.2
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

Scenario Timeframe:	Future
Receptor Population:	Resident
Receptor Age:	Adult/Lifetime[1]

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Adult Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Groundwater	Groundwater	Tap Water	**Volatile Organic Compounds**									
			1,1,2,2-Tetrachloroethane	6E-07	8E-08	4E-06	5E-06	Liver	4E-04	5E-05	NA	4E-04
			1,1-Dichloroethane	2E-06	2E-07	1E-05	2E-05	Kidney	4E-03	3E-04	NA	4E-03
			1,2,3-Trichlorobenzene	NA	NA	NA	NA	Body Weight/Liver/Thyroid	3E-01	NA	NA	3E-01
			1,2-Dichloroethane	3E-07	2E-08	2E-06	3E-06	Liver/Kidney	1E-03	7E-05	4E-02	4E-02
			1,4-Dichlorobenzene	7E-07	5E-07	3E-05	3E-05	Liver	4E-03	3E-03	1E-02	2E-02
			Benzene	6E-07	9E-08	2E-06	3E-06	Blood	6E-03	9E-04	2E-02	3E-02
			Bromodichloromethane	4E-07	3E-08	5E-06	6E-06	Liver	7E-04	6E-05	NA	8E-04
			Chlorobenzene	NA	NA	NA	NA	Liver/Kidney	5E-02	2E-02	5E-01	6E-01
			Chloroform	1E-06	1E-07	2E-05	3E-05	Liver/Alimentary System/ Kidney/Developmental	1E-02	9E-04	1E-02	2E-02
			cis-1,2-Dichloroethene	NA	NA	NA	NA	Kidney	8E-01	NA	NA	8E-01
			Trichloroethene	2E-04	3E-05	3E-04	5E-04	Heart/ Immune System/ Developmental/Kidney/Liver	1E+01	2E+00	8E+01	9E+01
			Vinyl Chloride	9E-04	5E-05	3E-03	4E-03	Liver	2E-01	1E-02	2E-01	4E-01
			Semi-volatile Organic Compounds									
			1,4-Dioxane	3E-05	1E-07	NA	3E-05	Liver/Kidney/CNS/Respiratory System	2E-02	8E-05	NA	2E-02
			2,3,4,6-Tetrachlorophenol	NA	NA	NA	NA	Liver	1E-01	NA	NA	1E-01
			Benzo(a)anthracene	1E-06	1E-05	NA	1E-05	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	4E-06	1E-04	NA	1E-04	NA	NA	NA	NA	NA
			Bis(2-Ethylhexyl)Phthalate	1E-06	2E-06	NA	3E-06	Liver	9E-03	1E-02	NA	2E-02
			Naphthalene	NA	NA	NA	NA	Body Weight/CNS/Respiratory System	2E-04	1E-04	NA	3E-04
			Inorganics									
			Antimony	NA	NA	NA	NA	Longevity/Blood/Lung	4E-01	1E-02	NA	4E-01
			Chromium	4E-03	2E-03	NA	6E-03	Lung	6E+00	3E+00	NA	9E+00
			Cobalt	NA	NA	NA	NA	Thyroid/Respiratory System/ Lung	1E+00	3E-03	NA	1E+00
			Iron	NA	NA	NA	NA	GI Tract	9E-01	5E-03	NA	9E-01
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	CNS	8E-01	5E-03	NA	8E-01
			Nickel	NA	NA	NA	NA	Body and Organ Weight/Respiratory System	2E+00	5E-02	NA	2E+00
			Thallium	NA	NA	NA	NA	Skin/Hair	2E-01	1E-03	NA	2E-01
			Chemical Total	5E-03	2E-03	3E-03	1E-02	Chemical Total	2E+01	5E+00	8E+01	1E+02
		Exposure Point Total					1E-02					1E+02
	Exposure Medium Total						1E-02					1E+02
Medium Total							1E-02					1E+02
Receptor Total							1E-02					1E+02

Total Excess Cancer Risk Across All Media	1E-02
Total Hazard Index (HI) Across All Media	110

[1] Noncancer hazards presented for the adult receptor; cancer risks presented for the lifetime receptor.

Alimentary System HI Across All Media =	0.02
Blood HI Across All Media =	0.4
Body and Organ Weight HI Across All Media =	2
Body weight HI Across All Media =	0.3
CNS HI Across All Media =	0.9
Development HI Across All Media =	93
GI Tract HI Across All Media =	0.9
Hair HI Across All Media =	0.2
Heart HI Across All Media =	93
Immune system HI Across All Media =	93
Kidney HI Across All Media =	94
Liver HI Across All Media =	94
Longevity HI Across All Media =	0.4
Lung HI Across All Media =	11
Respiratory System HI Across All Media =	3
Skin HI Across All Media =	0.2
Thyroid HI Across All Media =	2

NA = not applicable CNS = central nervous system GI = gastrointestinal

TABLE B-10.1
RISK ASSESSMENT SUMMARY
REASONABLE MAXIMUM EXPOSURE
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Resident
Receptor Age:	Child/Lifetime[1]

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Child Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Groundwater	Groundwater	Tap Water	**Volatile Organic Compounds**									
			1,1,2,2-Tetrachloroethane	6E-07	8E-08	4E-06	5E-06	Liver	6E-04	7E-05	NA	7E-04
			1,1-Dichloroethane	2E-06	2E-07	1E-05	2E-05	Kidney	7E-03	5E-04	NA	7E-03
			1,2-Dichloroethane	3E-07	2E-08	2E-06	3E-06	Liver/Kidney	2E-03	1E-04	3E-02	3E-02
			1,4-Dichlorobenzene	7E-07	5E-07	3E-05	3E-05	Liver	7E-03	5E-03	7E-03	2E-02
			Benzene	6E-07	9E-08	2E-06	3E-06	Blood	1E-02	2E-03	2E-02	3E-02
			Bromodichloromethane	4E-07	3E-08	5E-06	6E-06	Liver	1E-03	9E-05	NA	1E-03
			Chloroform	1E-06	1E-07	2E-05	3E-05	Liver/Alimentary System/ Kidney/Developmental	2E-02	1E-03	7E-03	3E-02
			cis-1,2-Dichloroethene	NA	NA	NA	NA	Kidney	1E+00	NA	NA	1E+00
			Trichloroethene	2E-04	3E-05	3E-04	5E-04	Heart/ Immune System/ Developmental/Kidney/Liver	2E+01	3E+00	6E+01	8E+01
			Vinyl Chloride	9E-04	5E-05	3E-03	4E-03	Liver	3E-01	2E-02	1E-01	5E-01
			Semi-volatile Organic Compounds									
			1,4-Dioxane	3E-05	1E-07	NA	3E-05	Liver/Kidney/CNS/Respiratory System	4E-02	1E-04	NA	4E-02
			Benzo(a)anthracene	1E-06	1E-05	NA	1E-05	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	4E-06	1E-04	NA	1E-04	NA	NA	NA	NA	NA
			Bis(2-Ethylhexyl)Phthalate	1E-06	2E-06	NA	3E-06	Liver	2E-02	2E-02	NA	4E-02
			Inorganics									
			Chromium	4E-03	2E-03	NA	6E-03	Lung	1E+01	5E+00	NA	1E+01
			Cobalt	NA	NA	NA	NA	Thyroid/Respiratory System/ Lung	2E+00	5E-03	NA	2E+00
			Iron	NA	NA	NA	NA	GI Tract	2E+00	8E-03	NA	2E+00
			Manganese	NA	NA	NA	NA	CNS	1E+00	8E-03	NA	1E+00
			Nickel	NA	NA	NA	NA	Body and Organ Weight/Respiratory System	3E+00	9E-02	NA	3E+00
			Chemical Total	5E-03	2E-03	3E-03	1E-02	Chemical Total	4E+01	8E+00	6E+01	1E+02
		Exposure Point Total					1E-02					1E+02
	Exposure Medium Total						1E-02					1E+02
Medium Total							1E-02					1E+02
Receptor Total							1E-02					1E+02
			Total Excess Cancer Risk Across All Media				1E-02	Total Hazard Index (HI) Across All Media				106

[1] Noncancer hazards presented for the child receptor (birth to <6 years); cancer risks presented for the lifetime receptor.

Body and Organ Weight HI Across All Media =	3
CNS HI Across All Media =	1
Development HI Across All Media =	79
GI Tract HI Across All Media =	2
Heart HI Across All Media =	79
Immune system HI Across All Media =	79
Kidney HI Across All Media =	81
Liver HI Across All Media =	81
Lung HI Across All Media =	18
Respiratory System HI Across All Media =	6
Thyroid HI Across All Media =	3

NA = not applicable CNS = central nervous system GI = gastrointestinal

Note:
Only chemicals above EPA's threshold values are listed in this table

TABLE B-10.2
RISK ASSESSMENT SUMMARY
REASONABLE MAXIMUM EXPOSURE
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

Scenario Timeframe:	Future
Receptor Population:	Resident
Receptor Age:	Adult/Lifetime[1]

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Adult Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
			1,1,2,2-Tetrachloroethane	6E-07	8E-08	4E-06	5E-06	Liver	4E-04	5E-05	NA	4E-04
			1,1-Dichloroethane	2E-06	2E-07	1E-05	2E-05	Kidney	4E-03	3E-04	NA	4E-03
			1,2-Dichloroethane	3E-07	2E-08	2E-06	3E-06	Liver/Kidney	1E-03	7E-05	4E-02	4E-02
			1,4-Dichlorobenzene	7E-07	5E-07	3E-05	3E-05	Liver	4E-03	3E-03	1E-02	2E-02
			Benzene	6E-07	9E-08	2E-06	3E-06	Blood	6E-03	9E-04	2E-02	3E-02
			Bromodichloromethane	4E-07	3E-08	5E-06	6E-06	Liver	7E-04	6E-05	NA	8E-04
			Chloroform	1E-06	1E-07	2E-05	3E-05	Liver/Alimentary System/ Kidney/Developmenta	1E-02	9E-04	1E-02	2E-02
			Trichloroethene	2E-04	3E-05	3E-04	5E-04	Heart/ Immune System/ Developmental/Kidney/Liver	1E+01	2E+00	8E+01	9E+01
			Vinyl Chloride	9E-04	5E-05	3E-03	4E-03	Liver	2E-01	1E-02	2E-01	4E-01
			1,4-Dioxane	3E-05	1E-07	NA	3E-05	Liver/Kidney/CNS/Respiratory System	2E-02	8E-05	NA	2E-02
			Benzo(a)anthracene	1E-06	1E-05	NA	1E-05	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	4E-06	1E-04	NA	1E-04	NA	NA	NA	NA	NA
			Bis(2-Ethylhexyl)Phthalate	1E-06	2E-06	NA	3E-06	Liver	9E-03	1E-02	NA	2E-02
			Chromium	4E-03	2E-03	NA	6E-03	Lung	6E+00	3E+00	NA	9E+00
			Cobalt	NA	NA	NA	NA	Thyroid/Respiratory System/ Lung	1E+00	3E-03	NA	1E+00
			Nickel	NA	NA	NA	NA	Body and Organ Weight/Respiratory System	2E+00	5E-02	NA	2E+00
			Chemical Total	5E-03	2E-03	3E-03	1E-02	Chemical Total	2E+01	5E+00	8E+01	1E+02
		Exposure Point Total					1E-02					1E+02
	Exposure Medium Total						1E-02					1E+02
Medium Total							1E-02					1E+02
Receptor Total							1E-02					1E+02

Total Excess Cancer Risk Across All Media	1E-02
Total Hazard Index (HI) Across All Media	110

[1] Noncancer hazards presented for the adult receptor; cancer risks presented for the lifetime receptor.

Body and Organ Weight HI Across All Media =	2
Development HI Across All Media =	93
Heart HI Across All Media =	93
Immune system HI Across All Media =	93
Kidney HI Across All Media =	94
Liver HI Across All Media =	94
Lung HI Across All Media =	11
Respiratory System HI Across All Media =	3
Thyroid HI Across All Media =	2

NA = not applicable CNS = central nervous system GI = gastrointestinal

Note:
Only chemicals above EPA's threshold values are listed in this table

Appendix C

Appendix C

ProUCL Output for Chemicals of Potential Concern – Groundwater

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.111/21/2016 10:59:24 AM
From File	HHRA_Updated_Locations_Redo_b.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

1,1-Dichloroethane

General Statistics

Total Number of Observations	10	Number of Distinct Observations	9
		Number of Missing Observations	0
Minimum	0.14	Mean	7.564
Maximum	35	Median	1.55
SD	11.28	Std. Error of Mean	3.567
Coefficient of Variation	1.491	Skewness	1.892

Normal GOF Test

Shapiro Wilk Test Statistic	0.718	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.842	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.289	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.262	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	14.1	95% Adjusted-CLT UCL (Chen-1995)	15.71
		95% Modified-t UCL (Johnson-1978)	14.46

Gamma GOF Test

A-D Test Statistic	0.433	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.781	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.196	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.282	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.478	k star (bias corrected MLE)	0.401
Theta hat (MLE)	15.84	Theta star (bias corrected MLE)	18.86
nu hat (MLE)	9.551	nu star (bias corrected)	8.019
MLE Mean (bias corrected)	7.564	MLE Sd (bias corrected)	11.95
		Approximate Chi Square Value (0.05)	2.746
Adjusted Level of Significance	0.0267	Adjusted Chi Square Value	2.239

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	22.09	95% Adjusted Gamma UCL (use when n<50)	27.09

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.939	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.842	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.152	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.262	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-1.966	Mean of logged Data	0.684
Maximum of Logged Data	3.555	SD of logged Data	1.938

Assuming Lognormal Distribution

95% H-UCL	384.9	90% Chebyshev (MVUE) UCL	25.61
95% Chebyshev (MVUE) UCL	33.2	97.5% Chebyshev (MVUE) UCL	43.75
99% Chebyshev (MVUE) UCL	64.47		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	13.43	95% Jackknife UCL	14.1
95% Standard Bootstrap UCL	13.27	95% Bootstrap-t UCL	19.62
95% Hall's Bootstrap UCL	16.33	95% Percentile Bootstrap UCL	13.15
95% BCA Bootstrap UCL	15.54		
90% Chebyshev(Mean, Sd) UCL	18.26	95% Chebyshev(Mean, Sd) UCL	23.11
97.5% Chebyshev(Mean, Sd) UCL	29.84	99% Chebyshev(Mean, Sd) UCL	43.05

Suggested UCL to Use

95% Adjusted Gamma UCL 27.09

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

1,2,3-Trichlorobenzene

General Statistics

Total Number of Observations	10	Number of Distinct Observations	5
Number of Detects	4	Number of Non-Detects	6
Number of Distinct Detects	4	Number of Distinct Non-Detects	1
Minimum Detect	2	Minimum Non-Detect	0.5
Maximum Detect	24	Maximum Non-Detect	0.5
Variance Detects	103.6	Percent Non-Detects	60%
Mean Detects	8.9	SD Detects	10.18
Median Detects	4.8	CV Detects	1.144
Skewness Detects	1.869	Kurtosis Detects	3.57
Mean of Logged Detects	1.743	SD of Logged Detects	1.05

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.765	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.373	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	3.86	KM Standard Error of Mean	2.53
KM SD	6.93	95% KM (BCA) UCL	N/A
95% KM (t) UCL	8.498	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	8.022	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	11.45	95% KM Chebyshev UCL	14.89
97.5% KM Chebyshev UCL	19.66	99% KM Chebyshev UCL	29.04

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.397	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.664	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.313	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.401	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.27	k star (bias corrected MLE)	0.484
Theta hat (MLE)	7.009	Theta star (bias corrected MLE)	18.38
nu hat (MLE)	10.16	nu star (bias corrected)	3.873
Mean (detects)	8.9		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	3.566
Maximum	24	Median	0.01
SD	7.458	CV	2.091
k hat (MLE)	0.218	k star (bias corrected MLE)	0.219
Theta hat (MLE)	16.39	Theta star (bias corrected MLE)	16.28
nu hat (MLE)	4.352	nu star (bias corrected)	4.38
Adjusted Level of Significance (β)	0.0267		
Approximate Chi Square Value (4.38, α)	0.877	Adjusted Chi Square Value (4.38, β)	0.642
95% Gamma Approximate UCL (use when n>=50)	17.8	95% Gamma Adjusted UCL (use when n<50)	N/A

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	3.86	SD (KM)	6.93
Variance (KM)	48.02	SE of Mean (KM)	2.53
k hat (KM)	0.31	k star (KM)	0.284
nu hat (KM)	6.206	nu star (KM)	5.677
theta hat (KM)	12.44	theta star (KM)	13.6
80% gamma percentile (KM)	5.835	90% gamma percentile (KM)	11.46
95% gamma percentile (KM)	17.97	99% gamma percentile (KM)	35.02

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (5.68, α)	1.477	Adjusted Chi Square Value (5.68, β)	1.139
95% Gamma Approximate KM-UCL (use when n>=50)	14.83	95% Gamma Adjusted KM-UCL (use when n<50)	19.24

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.949	**Shapiro Wilk GOF Test**

5% Shapiro Wilk Critical Value	0.748	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.251	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	3.698	Mean in Log Scale	-0.534
SD in Original Scale	7.39	SD in Log Scale	2.276
95% t UCL (assumes normality of ROS data)	7.982	95% Percentile Bootstrap UCL	7.966
95% BCA Bootstrap UCL	10.46	95% Bootstrap t UCL	21.06
95% H-UCL (Log ROS)	782.3		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	0.281	KM Geo Mean	1.325
KM SD (logged)	1.325	95% Critical H Value (KM-Log)	3.806
KM Standard Error of Mean (logged)	0.484	95% H-UCL (KM -Log)	17.11
KM SD (logged)	1.325	95% Critical H Value (KM-Log)	3.806
KM Standard Error of Mean (logged)	0.484		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	3.71	Mean in Log Scale	-0.135
SD in Original Scale	7.382	SD in Log Scale	1.726
95% t UCL (Assumes normality)	7.989	95% H-Stat UCL	59.19

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 8.498

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

1,2-Dichloroethane

General Statistics

Total Number of Observations	10	Number of Distinct Observations	5
Number of Detects	4	Number of Non-Detects	6
Number of Distinct Detects	4	Number of Distinct Non-Detects	1
Minimum Detect	0.1	Minimum Non-Detect	0.5
Maximum Detect	0.34	Maximum Non-Detect	0.5
Variance Detects	0.0118	Percent Non-Detects	60%
Mean Detects	0.188	SD Detects	0.109
Median Detects	0.155	CV Detects	0.58
Skewness Detects	1.332	Kurtosis Detects	1.285
Mean of Logged Detects	-1.791	SD of Logged Detects	0.546

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.88	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.241	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.188	KM Standard Error of Mean	0.0544
KM SD	0.0942	95% KM (BCA) UCL	N/A
95% KM (t) UCL	0.287	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	0.277	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	0.351	95% KM Chebyshev UCL	0.424
97.5% KM Chebyshev UCL	0.527	99% KM Chebyshev UCL	0.728

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.317	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.659	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.262	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.396	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	4.447	k star (bias corrected MLE)	1.278
Theta hat (MLE)	0.0422	Theta star (bias corrected MLE)	0.147
nu hat (MLE)	35.58	nu star (bias corrected)	10.23
Mean (detects)	0.188		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0494	Mean	0.189
Maximum	0.361	Median	0.171
SD	0.105	CV	0.557
k hat (MLE)	3.331	k star (bias corrected MLE)	2.399
Theta hat (MLE)	0.0568	Theta star (bias corrected MLE)	0.0788
nu hat (MLE)	66.63	nu star (bias corrected)	47.97
Adjusted Level of Significance (β)	0.0267		
Approximate Chi Square Value (47.97, α)	33.08	Adjusted Chi Square Value (47.97, β)	30.94
95% Gamma Approximate UCL (use when n>=50)	0.274	95% Gamma Adjusted UCL (use when n<50)	N/A

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.188	SD (KM)	0.0942
Variance (KM)	0.00887	SE of Mean (KM)	0.0544
k hat (KM)	3.964	k star (KM)	2.842
nu hat (KM)	79.28	nu star (KM)	56.83
theta hat (KM)	0.0473	theta star (KM)	0.066
80% gamma percentile (KM)	0.269	90% gamma percentile (KM)	0.337
95% gamma percentile (KM)	0.4	99% gamma percentile (KM)	0.537

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (56.83, α)	40.5	Adjusted Chi Square Value (56.83, β)	38.12
95% Gamma Approximate KM-UCL (use when n>=50)	0.263	95% Gamma Adjusted KM-UCL (use when n<50)	0.28

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.942	**Shapiro Wilk GOF Test**

5% Shapiro Wilk Critical Value	0.748	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.227	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.189	Mean in Log Scale	-1.791
SD in Original Scale	0.102	SD in Log Scale	0.531
95% t UCL (assumes normality of ROS data)	0.248	95% Percentile Bootstrap UCL	0.241
95% BCA Bootstrap UCL	0.246	95% Bootstrap t UCL	0.263
95% H-UCL (Log ROS)	0.287		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.791	KM Geo Mean	0.167
KM SD (logged)	0.473	95% Critical H Value (KM-Log)	2.183
KM Standard Error of Mean (logged)	0.273	95% H-UCL (KM -Log)	0.263
KM SD (logged)	0.473	95% Critical H Value (KM-Log)	2.183
KM Standard Error of Mean (logged)	0.273		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.225	Mean in Log Scale	-1.548
SD in Original Scale	0.0706	SD in Log Scale	0.378
95% t UCL (Assumes normality)	0.266	95% H-Stat UCL	0.296

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.287

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

1,4-Dichlorobenzene

General Statistics

Total Number of Observations	10	Number of Distinct Observations	6
Number of Detects	5	Number of Non-Detects	5
Number of Distinct Detects	5	Number of Distinct Non-Detects	1
Minimum Detect	0.21	Minimum Non-Detect	0.5
Maximum Detect	13	Maximum Non-Detect	0.5
Variance Detects	28.21	Percent Non-Detects	50%
Mean Detects	3.686	SD Detects	5.311
Median Detects	2.3	CV Detects	1.441
Skewness Detects	2.022	Kurtosis Detects	4.24
Mean of Logged Detects	0.377	SD of Logged Detects	1.627

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.718	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.388	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	2.001	KM Standard Error of Mean	1.33
KM SD	3.759	95% KM (BCA) UCL	4.339
95% KM (t) UCL	4.438	95% KM (Percentile Bootstrap) UCL	4.339
95% KM (z) UCL	4.188	95% KM Bootstrap t UCL	10.18
90% KM Chebyshev UCL	5.99	95% KM Chebyshev UCL	7.797
97.5% KM Chebyshev UCL	10.31	99% KM Chebyshev UCL	15.23

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.339	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.703	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.249	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.369	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.657	k star (bias corrected MLE)	0.396
Theta hat (MLE)	5.606	Theta star (bias corrected MLE)	9.3
nu hat (MLE)	6.575	nu star (bias corrected)	3.963
Mean (detects)	3.686		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	1.95
Maximum	13	Median	0.315
SD	3.997	CV	2.05
k hat (MLE)	0.298	k star (bias corrected MLE)	0.275
Theta hat (MLE)	6.548	Theta star (bias corrected MLE)	7.087
nu hat (MLE)	5.956	nu star (bias corrected)	5.502
Adjusted Level of Significance (β)	0.0267		
Approximate Chi Square Value (5.50, α)	1.391	Adjusted Chi Square Value (5.50, β)	1.066
95% Gamma Approximate UCL (use when n>=50)	7.713	95% Gamma Adjusted UCL (use when n<50)	10.06

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	2.001	SD (KM)	3.759
Variance (KM)	14.13	SE of Mean (KM)	1.33
k hat (KM)	0.283	k star (KM)	0.265
nu hat (KM)	5.665	nu star (KM)	5.299
theta hat (KM)	7.063	theta star (KM)	7.551
80% gamma percentile (KM)	2.963	90% gamma percentile (KM)	5.977
95% gamma percentile (KM)	9.515	99% gamma percentile (KM)	18.86

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (5.30, α)	1.293	Adjusted Chi Square Value (5.30, β)	0.984
95% Gamma Approximate KM-UCL (use when n>=50)	8.2	95% Gamma Adjusted KM-UCL (use when n<50)	10.78

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.95	**Shapiro Wilk GOF Test**

5% Shapiro Wilk Critical Value	0.762	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.21	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	2.038	Mean in Log Scale	-0.453
SD in Original Scale	3.95	SD in Log Scale	1.542
95% t UCL (assumes normality of ROS data)	4.328	95% Percentile Bootstrap UCL	4.361
95% BCA Bootstrap UCL	5.582	95% Bootstrap t UCL	10.61
95% H-UCL (Log ROS)	19.07		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.418	KM Geo Mean	0.658
KM SD (logged)	1.324	95% Critical H Value (KM-Log)	3.803
KM Standard Error of Mean (logged)	0.495	95% H-UCL (KM -Log)	8.461
KM SD (logged)	1.324	95% Critical H Value (KM-Log)	3.803
KM Standard Error of Mean (logged)	0.495		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	1.968	Mean in Log Scale	-0.505
SD in Original Scale	3.977	SD in Log Scale	1.428
95% t UCL (Assumes normality)	4.273	95% H-Stat UCL	11.47

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Bootstrap t UCL	10.18	usted KM-UCL (use when k<=1 and 15 < n < 50 but k<=1)	10.78

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Benzene

General Statistics

Total Number of Observations	10	Number of Distinct Observations	8
Number of Detects	7	Number of Non-Detects	3
Number of Distinct Detects	7	Number of Distinct Non-Detects	1
Minimum Detect	0.16	Minimum Non-Detect	0.5
Maximum Detect	1.6	Maximum Non-Detect	0.5
Variance Detects	0.249	Percent Non-Detects	30%
Mean Detects	0.664	SD Detects	0.499
Median Detects	0.59	CV Detects	0.751
Skewness Detects	1.21	Kurtosis Detects	1.193
Mean of Logged Detects	-0.657	SD of Logged Detects	0.781

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.895	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.21	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.544	KM Standard Error of Mean	0.148
KM SD	0.43	95% KM (BCA) UCL	0.822
95% KM (t) UCL	0.815	95% KM (Percentile Bootstrap) UCL	0.794
95% KM (z) UCL	0.787	95% KM Bootstrap t UCL	0.979
90% KM Chebyshev UCL	0.988	95% KM Chebyshev UCL	1.189
97.5% KM Chebyshev UCL	1.468	99% KM Chebyshev UCL	2.017

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.208	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.714	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.193	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.315	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	2.166	k star (bias corrected MLE)	1.333
Theta hat (MLE)	0.307	Theta star (bias corrected MLE)	0.498
nu hat (MLE)	30.32	nu star (bias corrected)	18.66
Mean (detects)	0.664		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0519	Mean	0.53
Maximum	1.6	Median	0.351
SD	0.468	CV	0.882
k hat (MLE)	1.494	k star (bias corrected MLE)	1.113
Theta hat (MLE)	0.355	Theta star (bias corrected MLE)	0.476
nu hat (MLE)	29.88	nu star (bias corrected)	22.25
Adjusted Level of Significance (β)	0.0267		
Approximate Chi Square Value (22.25, α)	12.53	Adjusted Chi Square Value (22.25, β)	11.28
95% Gamma Approximate UCL (use when n>=50)	0.941	95% Gamma Adjusted UCL (use when n<50)	1.046

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.544	SD (KM)	0.43
Variance (KM)	0.185	SE of Mean (KM)	0.148
k hat (KM)	1.603	k star (KM)	1.189
nu hat (KM)	32.07	nu star (KM)	23.78
theta hat (KM)	0.339	theta star (KM)	0.458
80% gamma percentile (KM)	0.862	90% gamma percentile (KM)	1.2
95% gamma percentile (KM)	1.534	99% gamma percentile (KM)	2.299

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (23.78, α)	13.68	Adjusted Chi Square Value (23.78, β)	12.37
95% Gamma Approximate KM-UCL (use when n>=50)	0.946	95% Gamma Adjusted KM-UCL (use when n<50)	1.046

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.979	**Shapiro Wilk GOF Test**

5% Shapiro Wilk Critical Value	0.803	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.16	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.543	Mean in Log Scale	-0.879
SD in Original Scale	0.454	SD in Log Scale	0.755
95% t UCL (assumes normality of ROS data)	0.806	95% Percentile Bootstrap UCL	0.799
95% BCA Bootstrap UCL	0.844	95% Bootstrap t UCL	1.082
95% H-UCL (Log ROS)	1.071		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.874	KM Geo Mean	0.417
KM SD (logged)	0.712	95% Critical H Value (KM-Log)	2.553
KM Standard Error of Mean (logged)	0.257	95% H-UCL (KM -Log)	0.985
KM SD (logged)	0.712	95% Critical H Value (KM-Log)	2.553
KM Standard Error of Mean (logged)	0.257		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.54	Mean in Log Scale	-0.876
SD in Original Scale	0.454	SD in Log Scale	0.729
95% t UCL (Assumes normality)	0.803	95% H-Stat UCL	1.017

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.815

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Bromodichloromethane

General Statistics

Total Number of Observations	10	Number of Distinct Observations	8
Number of Detects	7	Number of Non-Detects	3
Number of Distinct Detects	7	Number of Distinct Non-Detects	1
Minimum Detect	0.1	Minimum Non-Detect	0.5
Maximum Detect	0.71	Maximum Non-Detect	0.5
Variance Detects	0.048	Percent Non-Detects	30%
Mean Detects	0.374	SD Detects	0.219
Median Detects	0.31	CV Detects	0.585
Skewness Detects	0.429	Kurtosis Detects	-0.929
Mean of Logged Detects	-1.16	SD of Logged Detects	0.683

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.96	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.187	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.341	KM Standard Error of Mean	0.0699
KM SD	0.188	95% KM (BCA) UCL	0.448
95% KM (t) UCL	0.469	95% KM (Percentile Bootstrap) UCL	0.452
95% KM (z) UCL	0.456	95% KM Bootstrap t UCL	0.489
90% KM Chebyshev UCL	0.551	95% KM Chebyshev UCL	0.646
97.5% KM Chebyshev UCL	0.778	99% KM Chebyshev UCL	1.037

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.179	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.712	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.136	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.314	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	2.982	k star (bias corrected MLE)	1.8
Theta hat (MLE)	0.125	Theta star (bias corrected MLE)	0.208
nu hat (MLE)	41.75	nu star (bias corrected)	25.19
Mean (detects)	0.374		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.1	Mean	0.34
Maximum	0.71	Median	0.3
SD	0.193	CV	0.569
k hat (MLE)	3.411	k star (bias corrected MLE)	2.454
Theta hat (MLE)	0.0996	Theta star (bias corrected MLE)	0.138
nu hat (MLE)	68.22	nu star (bias corrected)	49.09
Adjusted Level of Significance (β)	0.0267		
Approximate Chi Square Value (49.09, α)	34	Adjusted Chi Square Value (49.09, β)	31.83
95% Gamma Approximate UCL (use when n>=50)	0.491	95% Gamma Adjusted UCL (use when n<50)	0.524

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.341	SD (KM)	0.188
Variance (KM)	0.0354	SE of Mean (KM)	0.0699
k hat (KM)	3.289	k star (KM)	2.369
nu hat (KM)	65.78	nu star (KM)	47.38
theta hat (KM)	0.104	theta star (KM)	0.144
80% gamma percentile (KM)	0.501	90% gamma percentile (KM)	0.638
95% gamma percentile (KM)	0.768	99% gamma percentile (KM)	1.053

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (47.38, α)	32.58	Adjusted Chi Square Value (47.38, β)	30.46
95% Gamma Approximate KM-UCL (use when n>=50)	0.496	95% Gamma Adjusted KM-UCL (use when n<50)	0.531

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.96	**Shapiro Wilk GOF Test**

5% Shapiro Wilk Critical Value	0.803	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.169	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.334	Mean in Log Scale	-1.255
SD in Original Scale	0.195	SD in Log Scale	0.608
95% t UCL (assumes normality of ROS data)	0.447	95% Percentile Bootstrap UCL	0.434
95% BCA Bootstrap UCL	0.444	95% Bootstrap t UCL	0.496
95% H-UCL (Log ROS)	0.555		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.247	KM Geo Mean	0.287
KM SD (logged)	0.614	95% Critical H Value (KM-Log)	2.39
KM Standard Error of Mean (logged)	0.242	95% H-UCL (KM -Log)	0.566
KM SD (logged)	0.614	95% Critical H Value (KM-Log)	2.39
KM Standard Error of Mean (logged)	0.242		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.337	Mean in Log Scale	-1.228
SD in Original Scale	0.189	SD in Log Scale	0.569
95% t UCL (Assumes normality)	0.446	95% H-Stat UCL	0.535

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.469

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Chlorobenzene

General Statistics

Total Number of Observations	10	Number of Distinct Observations	6
Number of Detects	5	Number of Non-Detects	5
Number of Distinct Detects	5	Number of Distinct Non-Detects	1
Minimum Detect	3.2	Minimum Non-Detect	0.5
Maximum Detect	70	Maximum Non-Detect	0.5
Variance Detects	876.6	Percent Non-Detects	50%
Mean Detects	31.2	SD Detects	29.61
Median Detects	19	CV Detects	0.949
Skewness Detects	0.592	Kurtosis Detects	-2.346
Mean of Logged Detects	2.908	SD of Logged Detects	1.283

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.88	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.26	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	15.85	KM Standard Error of Mean	8.561
KM SD	24.21	95% KM (BCA) UCL	28.87
95% KM (t) UCL	31.54	95% KM (Percentile Bootstrap) UCL	28.81
95% KM (z) UCL	29.93	95% KM Bootstrap t UCL	48.72
90% KM Chebyshev UCL	41.53	95% KM Chebyshev UCL	53.16
97.5% KM Chebyshev UCL	69.31	99% KM Chebyshev UCL	101

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.276	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.691	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.231	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.364	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.074	k star (bias corrected MLE)	0.563
Theta hat (MLE)	29.04	Theta star (bias corrected MLE)	55.4
nu hat (MLE)	10.74	nu star (bias corrected)	5.631
Mean (detects)	31.2		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	15.61
Maximum	70	Median	1.605
SD	25.69	CV	1.646
k hat (MLE)	0.204	k star (bias corrected MLE)	0.209
Theta hat (MLE)	76.5	Theta star (bias corrected MLE)	74.5
nu hat (MLE)	4.08	nu star (bias corrected)	4.189
Adjusted Level of Significance (β)	0.0267		
Approximate Chi Square Value (4.19, α)	0.798	Adjusted Chi Square Value (4.19, β)	0.579
95% Gamma Approximate UCL (use when n>=50)	81.93	95% Gamma Adjusted UCL (use when n<50)	112.9

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	15.85	SD (KM)	24.21
Variance (KM)	586.3	SE of Mean (KM)	8.561
k hat (KM)	0.429	k star (KM)	0.367
nu hat (KM)	8.57	nu star (KM)	7.332
theta hat (KM)	36.99	theta star (KM)	43.23
80% gamma percentile (KM)	25.29	90% gamma percentile (KM)	45.44
95% gamma percentile (KM)	67.85	99% gamma percentile (KM)	124.8

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (7.33, α)	2.355	Adjusted Chi Square Value (7.33, β)	1.895
95% Gamma Approximate KM-UCL (use when n>=50)	49.35	95% Gamma Adjusted KM-UCL (use when n<50)	61.32

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.943	**Shapiro Wilk GOF Test**

5% Shapiro Wilk Critical Value	0.762	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.204	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	15.9	Mean in Log Scale	0.947
SD in Original Scale	25.49	SD in Log Scale	2.382
95% t UCL (assumes normality of ROS data)	30.68	95% Percentile Bootstrap UCL	29.47
95% BCA Bootstrap UCL	34.81	95% Bootstrap t UCL	67.48
95% H-UCL (Log ROS)	6703		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	1.107	KM Geo Mean	3.026
KM SD (logged)	1.975	95% Critical H Value (KM-Log)	5.335
KM Standard Error of Mean (logged)	0.698	95% H-UCL (KM -Log)	713
KM SD (logged)	1.975	95% Critical H Value (KM-Log)	5.335
KM Standard Error of Mean (logged)	0.698		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	15.73	Mean in Log Scale	0.761
SD in Original Scale	25.61	SD in Log Scale	2.419
95% t UCL (Assumes normality)	30.57	95% H-Stat UCL	7090

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 31.54

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Chloroform

General Statistics

Total Number of Observations	10	Number of Distinct Observations	8
Number of Detects	7	Number of Non-Detects	3
Number of Distinct Detects	7	Number of Distinct Non-Detects	1
Minimum Detect	0.56	Minimum Non-Detect	0.5
Maximum Detect	7.4	Maximum Non-Detect	0.5
Variance Detects	5.388	Percent Non-Detects	30%
Mean Detects	2.694	SD Detects	2.321
Median Detects	1.8	CV Detects	0.862
Skewness Detects	1.656	Kurtosis Detects	2.973
Mean of Logged Detects	0.694	SD of Logged Detects	0.843

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.842	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.221	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	2.036	KM Standard Error of Mean	0.704
KM SD	2.06	95% KM (BCA) UCL	3.23
95% KM (t) UCL	3.326	95% KM (Percentile Bootstrap) UCL	3.246
95% KM (z) UCL	3.193	95% KM Bootstrap t UCL	4.395
90% KM Chebyshev UCL	4.147	95% KM Chebyshev UCL	5.103
97.5% KM Chebyshev UCL	6.43	99% KM Chebyshev UCL	9.037

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.199	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.717	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.172	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.316	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.83	k star (bias corrected MLE)	1.141
Theta hat (MLE)	1.472	Theta star (bias corrected MLE)	2.361
nu hat (MLE)	25.62	nu star (bias corrected)	15.97
Mean (detects)	2.694		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	1.889
Maximum	7.4	Median	1.3
SD	2.296	CV	1.216
k hat (MLE)	0.425	k star (bias corrected MLE)	0.364
Theta hat (MLE)	4.441	Theta star (bias corrected MLE)	5.184
nu hat (MLE)	8.506	nu star (bias corrected)	7.288
Adjusted Level of Significance (β)	0.0267		
Approximate Chi Square Value (7.29, α)	2.33	Adjusted Chi Square Value (7.29, β)	1.873
95% Gamma Approximate UCL (use when n>=50)	5.909	95% Gamma Adjusted UCL (use when n<50)	7.349

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	2.036	SD (KM)	2.06
Variance (KM)	4.244	SE of Mean (KM)	0.704
k hat (KM)	0.977	k star (KM)	0.75
nu hat (KM)	19.53	nu star (KM)	15.01
theta hat (KM)	2.085	theta star (KM)	2.713
80% gamma percentile (KM)	3.338	90% gamma percentile (KM)	5.027
95% gamma percentile (KM)	6.759	99% gamma percentile (KM)	10.87

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (15.01, α)	7.267	Adjusted Chi Square Value (15.01, β)	6.353
95% Gamma Approximate KM-UCL (use when n>=50)	4.205	95% Gamma Adjusted KM-UCL (use when n<50)	4.809

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.995	**Shapiro Wilk GOF Test**

5% Shapiro Wilk Critical Value	0.803	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.121	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	1.958	Mean in Log Scale	0.0322
SD in Original Scale	2.236	SD in Log Scale	1.29
95% t UCL (assumes normality of ROS data)	3.254	95% Percentile Bootstrap UCL	3.146
95% BCA Bootstrap UCL	3.55	95% Bootstrap t UCL	4.38
95% H-UCL (Log ROS)	11.78		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	0.278	KM Geo Mean	1.32
KM SD (logged)	0.911	95% Critical H Value (KM-Log)	2.924
KM Standard Error of Mean (logged)	0.311	95% H-UCL (KM -Log)	4.862
KM SD (logged)	0.911	95% Critical H Value (KM-Log)	2.924
KM Standard Error of Mean (logged)	0.311		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	1.961	Mean in Log Scale	0.0697
SD in Original Scale	2.233	SD in Log Scale	1.218
95% t UCL (Assumes normality)	3.255	95% H-Stat UCL	9.584

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 3.326

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

cis-1,2-Dichloroethene

General Statistics

Total Number of Observations	10	Number of Distinct Observations	10
		Number of Missing Observations	0
Minimum	1.7	Mean	34.34
Maximum	90	Median	24.5
SD	32.32	Std. Error of Mean	10.22
Coefficient of Variation	0.941	Skewness	0.675

Normal GOF Test

Shapiro Wilk Test Statistic	0.887	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.842	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.202	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.262	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	53.08	95% Adjusted-CLT UCL (Chen-1995)	53.48
		95% Modified-t UCL (Johnson-1978)	53.44

Gamma GOF Test

A-D Test Statistic	0.299	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.752	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.159	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.275	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.888	k star (bias corrected MLE)	0.688
Theta hat (MLE)	38.66	Theta star (bias corrected MLE)	49.88
nu hat (MLE)	17.77	nu star (bias corrected)	13.77
MLE Mean (bias corrected)	34.34	MLE Sd (bias corrected)	41.39
		Approximate Chi Square Value (0.05)	6.414
Adjusted Level of Significance	0.0267	Adjusted Chi Square Value	5.565

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	73.72	95% Adjusted Gamma UCL (use when n<50)	84.97

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.917	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.842	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.172	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.262	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	0.531	Mean of logged Data	2.877
Maximum of Logged Data	4.5	SD of logged Data	1.415

Assuming Lognormal Distribution

95% H-UCL	321	90% Chebyshev (MVUE) UCL	99.44
95% Chebyshev (MVUE) UCL	125.9	97.5% Chebyshev (MVUE) UCL	162.6
99% Chebyshev (MVUE) UCL	234.6		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	51.15	95% Jackknife UCL	53.08
95% Standard Bootstrap UCL	50.42	95% Bootstrap-t UCL	55.81
95% Hall's Bootstrap UCL	53.91	95% Percentile Bootstrap UCL	51.77
95% BCA Bootstrap UCL	51.77		
90% Chebyshev(Mean, Sd) UCL	65	95% Chebyshev(Mean, Sd) UCL	78.89
97.5% Chebyshev(Mean, Sd) UCL	98.17	99% Chebyshev(Mean, Sd) UCL	136

Suggested UCL to Use

95% Student's-t UCL 53.08

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Trichloroethene

General Statistics

Total Number of Observations	10	Number of Distinct Observations	10
		Number of Missing Observations	0
Minimum	3.8	Mean	60.6
Maximum	270	Median	13.5
SD	87.69	Std. Error of Mean	27.73
Coefficient of Variation	1.447	Skewness	1.823

Normal GOF Test

Shapiro Wilk Test Statistic	0.709	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.842	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.319	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.262	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	111.4	95% Adjusted-CLT UCL (Chen-1995)	123.3
		95% Modified-t UCL (Johnson-1978)	114.1

Gamma GOF Test

A-D Test Statistic	0.708	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.768	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.244	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.279	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.613	k star (bias corrected MLE)	0.496
Theta hat (MLE)	98.79	Theta star (bias corrected MLE)	122.2
nu hat (MLE)	12.27	nu star (bias corrected)	9.921
MLE Mean (bias corrected)	60.6	MLE Sd (bias corrected)	86.04
		Approximate Chi Square Value (0.05)	3.892
Adjusted Level of Significance	0.0267	Adjusted Chi Square Value	3.263

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	154.5	95% Adjusted Gamma UCL (use when n<50)	184.2

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.902	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.842	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.201	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.262	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.335	Mean of logged Data	3.1
Maximum of Logged Data	5.598	SD of logged Data	1.514

Assuming Lognormal Distribution

95% H-UCL	593.7	90% Chebyshev (MVUE) UCL	144.6
95% Chebyshev (MVUE) UCL	184.1	97.5% Chebyshev (MVUE) UCL	238.9
99% Chebyshev (MVUE) UCL	346.6		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	106.2	95% Jackknife UCL	111.4
95% Standard Bootstrap UCL	104.5	95% Bootstrap-t UCL	154.9
95% Hall's Bootstrap UCL	113.2	95% Percentile Bootstrap UCL	107.5
95% BCA Bootstrap UCL	121.9		
90% Chebyshev(Mean, Sd) UCL	143.8	95% Chebyshev(Mean, Sd) UCL	181.5
97.5% Chebyshev(Mean, Sd) UCL	233.8	99% Chebyshev(Mean, Sd) UCL	336.5

Suggested UCL to Use

95% Adjusted Gamma UCL 184.2

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Vinyl Chloride

General Statistics

Total Number of Observations	10	Number of Distinct Observations	7
Number of Detects	6	Number of Non-Detects	4
Number of Distinct Detects	6	Number of Distinct Non-Detects	1
Minimum Detect	0.18	Minimum Non-Detect	0.5
Maximum Detect	50	Maximum Non-Detect	0.5
Variance Detects	422.9	Percent Non-Detects	40%
Mean Detects	15.46	SD Detects	20.56
Median Detects	5.7	CV Detects	1.33
Skewness Detects	1.217	Kurtosis Detects	0.0966
Mean of Logged Detects	1.177	SD of Logged Detects	2.445

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.806	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.288	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.325	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	9.354	KM Standard Error of Mean	5.665
KM SD	16.35	95% KM (BCA) UCL	18.76
95% KM (t) UCL	19.74	95% KM (Percentile Bootstrap) UCL	19.1
95% KM (z) UCL	18.67	95% KM Bootstrap t UCL	56.74
90% KM Chebyshev UCL	26.35	95% KM Chebyshev UCL	34.05
97.5% KM Chebyshev UCL	44.73	99% KM Chebyshev UCL	65.72

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.317	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.748	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.206	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.352	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.418	k star (bias corrected MLE)	0.32
Theta hat (MLE)	36.96	Theta star (bias corrected MLE)	48.27
nu hat (MLE)	5.021	nu star (bias corrected)	3.844
Mean (detects)	15.46		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	9.282
Maximum	50	Median	0.19
SD	17.28	CV	1.862
k hat (MLE)	0.216	k star (bias corrected MLE)	0.218
Theta hat (MLE)	42.95	Theta star (bias corrected MLE)	42.59
nu hat (MLE)	4.322	nu star (bias corrected)	4.359
Adjusted Level of Significance (β)	0.0267		
Approximate Chi Square Value (4.36, α)	0.868	Adjusted Chi Square Value (4.36, β)	0.635
95% Gamma Approximate UCL (use when n>=50)	46.59	95% Gamma Adjusted UCL (use when n<50)	63.69

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	9.354	SD (KM)	16.35
Variance (KM)	267.4	SE of Mean (KM)	5.665
k hat (KM)	0.327	k star (KM)	0.296
nu hat (KM)	6.543	nu star (KM)	5.914
theta hat (KM)	28.59	theta star (KM)	31.63
80% gamma percentile (KM)	14.29	90% gamma percentile (KM)	27.64
95% gamma percentile (KM)	42.99	99% gamma percentile (KM)	82.96

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (5.91, α)	1.596	Adjusted Chi Square Value (5.91, β)	1.239
95% Gamma Approximate KM-UCL (use when n>=50)	34.66	95% Gamma Adjusted KM-UCL (use when n<50)	44.63

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.889	**Shapiro Wilk GOF Test**	

5% Shapiro Wilk Critical Value	0.788	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.206	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	9.417	Mean in Log Scale	0.0513
SD in Original Scale	17.2	SD in Log Scale	2.463
95% t UCL (assumes normality of ROS data)	19.39	95% Percentile Bootstrap UCL	18.75
95% BCA Bootstrap UCL	21.57	95% Bootstrap t UCL	58.9
95% H-UCL (Log ROS)	4656		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	0.0414	KM Geo Mean	1.042
KM SD (logged)	2.219	95% Critical H Value (KM-Log)	5.929
KM Standard Error of Mean (logged)	0.769	95% H-UCL (KM -Log)	981.4
KM SD (logged)	2.219	95% Critical H Value (KM-Log)	5.929
KM Standard Error of Mean (logged)	0.769		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	9.378	Mean in Log Scale	0.152
SD in Original Scale	17.22	SD in Log Scale	2.252
95% t UCL (Assumes normality)	19.36	95% H-Stat UCL	1340

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 19.74

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

1,4-Dioxane

General Statistics

Total Number of Observations	10	Number of Distinct Observations	10
Number of Detects	9	Number of Non-Detects	1
Number of Distinct Detects	9	Number of Distinct Non-Detects	1
Minimum Detect	0.15	Minimum Non-Detect	0.5
Maximum Detect	26	Maximum Non-Detect	0.5
Variance Detects	87.9	Percent Non-Detects	10%
Mean Detects	6.339	SD Detects	9.375
Median Detects	0.78	CV Detects	1.479
Skewness Detects	1.581	Kurtosis Detects	1.475
Mean of Logged Detects	0.395	SD of Logged Detects	2.011

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.725	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.296	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	5.729	KM Standard Error of Mean	2.879
KM SD	8.583	95% KM (BCA) UCL	10.76
95% KM (t) UCL	11.01	95% KM (Percentile Bootstrap) UCL	10.56
95% KM (z) UCL	10.46	95% KM Bootstrap t UCL	22.53
90% KM Chebyshev UCL	14.37	95% KM Chebyshev UCL	18.28
97.5% KM Chebyshev UCL	23.71	99% KM Chebyshev UCL	34.37

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.627	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.781	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.251	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.296	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.446	k star (bias corrected MLE)	0.371
Theta hat (MLE)	14.23	Theta star (bias corrected MLE)	17.08
nu hat (MLE)	8.02	nu star (bias corrected)	6.68
Mean (detects)	6.339		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	5.706
Maximum	26	Median	0.545
SD	9.063	CV	1.588
k hat (MLE)	0.362	k star (bias corrected MLE)	0.32
Theta hat (MLE)	15.75	Theta star (bias corrected MLE)	17.82
nu hat (MLE)	7.243	nu star (bias corrected)	6.404
Adjusted Level of Significance (β)	0.0267		
Approximate Chi Square Value (6.40, α)	1.85	Adjusted Chi Square Value (6.40, β)	1.456
95% Gamma Approximate UCL (use when n>=50)	19.76	95% Gamma Adjusted UCL (use when n<50)	25.09

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	5.729	SD (KM)	8.583
Variance (KM)	73.66	SE of Mean (KM)	2.879
k hat (KM)	0.446	k star (KM)	0.379
nu hat (KM)	8.912	nu star (KM)	7.572
theta hat (KM)	12.86	theta star (KM)	15.13
80% gamma percentile (KM)	9.182	90% gamma percentile (KM)	16.34
95% gamma percentile (KM)	24.26	99% gamma percentile (KM)	44.3

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (7.57, α)	2.49	Adjusted Chi Square Value (7.57, β)	2.013
95% Gamma Approximate KM-UCL (use when n>=50)	17.42	95% Gamma Adjusted KM-UCL (use when n<50)	21.55

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.874	**Shapiro Wilk GOF Test**

5% Shapiro Wilk Critical Value	0.829	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.226	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.274	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	5.733	Mean in Log Scale	0.229
SD in Original Scale	9.044	SD in Log Scale	1.967
95% t UCL (assumes normality of ROS data)	10.98	95% Percentile Bootstrap UCL	10.61
95% BCA Bootstrap UCL	11.71	95% Bootstrap t UCL	23.08
95% H-UCL (Log ROS)	284.4		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	0.211	KM Geo Mean	1.234
KM SD (logged)	1.884	95% Critical H Value (KM-Log)	5.115
KM Standard Error of Mean (logged)	0.633	95% H-UCL (KM -Log)	180.6
KM SD (logged)	1.884	95% Critical H Value (KM-Log)	5.115
KM Standard Error of Mean (logged)	0.633		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	5.73	Mean in Log Scale	0.217
SD in Original Scale	9.047	SD in Log Scale	1.978
95% t UCL (Assumes normality)	10.97	95% H-Stat UCL	297

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Bootstrap t UCL	22.53	usted KM-UCL (use when k<=1 and 15 < n < 50 but k<=1)	21.55

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Bis(2-ethylhexyl)phthalate

General Statistics

Total Number of Observations	10	Number of Distinct Observations	5
Number of Detects	4	Number of Non-Detects	6
Number of Distinct Detects	4	Number of Distinct Non-Detects	1
Minimum Detect	1.7	Minimum Non-Detect	5
Maximum Detect	12	Maximum Non-Detect	5
Variance Detects	22.81	Percent Non-Detects	60%
Mean Detects	5.1	SD Detects	4.776
Median Detects	3.35	CV Detects	0.936
Skewness Detects	1.604	Kurtosis Detects	2.402
Mean of Logged Detects	1.321	SD of Logged Detects	0.886

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.822	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.292	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	3.72	KM Standard Error of Mean	1.268
KM SD	3.017	95% KM (BCA) UCL	N/A
95% KM (t) UCL	6.045	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	5.806	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	7.525	95% KM Chebyshev UCL	9.248
97.5% KM Chebyshev UCL	11.64	99% KM Chebyshev UCL	16.34

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.369	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.661	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.277	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.399	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.77	k star (bias corrected MLE)	0.609
Theta hat (MLE)	2.882	Theta star (bias corrected MLE)	8.372
nu hat (MLE)	14.16	nu star (bias corrected)	4.873
Mean (detects)	5.1		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.278	Mean	3.817
Maximum	12	Median	2.717
SD	3.398	CV	0.89
k hat (MLE)	1.433	k star (bias corrected MLE)	1.07
Theta hat (MLE)	2.663	Theta star (bias corrected MLE)	3.567
nu hat (MLE)	28.67	nu star (bias corrected)	21.4
Adjusted Level of Significance (β)	0.0267		
Approximate Chi Square Value (21.40, α)	11.89	Adjusted Chi Square Value (21.40, β)	10.68
95% Gamma Approximate UCL (use when n>=50)	6.871	95% Gamma Adjusted UCL (use when n<50)	N/A

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	3.72	SD (KM)	3.017
Variance (KM)	9.1	SE of Mean (KM)	1.268
k hat (KM)	1.521	k star (KM)	1.131
nu hat (KM)	30.42	nu star (KM)	22.62
theta hat (KM)	2.446	theta star (KM)	3.289
80% gamma percentile (KM)	5.923	90% gamma percentile (KM)	8.309
95% gamma percentile (KM)	10.67	99% gamma percentile (KM)	16.11

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (22.62, α)	12.81	Adjusted Chi Square Value (22.62, β)	11.54
95% Gamma Approximate KM-UCL (use when n>=50)	6.571	95% Gamma Adjusted KM-UCL (use when n<50)	7.291

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.923	**Shapiro Wilk GOF Test**

5% Shapiro Wilk Critical Value	0.748	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.243	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	3.778	Mean in Log Scale	1.085
SD in Original Scale	3.214	SD in Log Scale	0.703
95% t UCL (assumes normality of ROS data)	5.641	95% Percentile Bootstrap UCL	5.455
95% BCA Bootstrap UCL	6.251	95% Bootstrap t UCL	7.676
95% H-UCL (Log ROS)	6.859		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	1.088	KM Geo Mean	2.969
KM SD (logged)	0.618	95% Critical H Value (KM-Log)	2.396
KM Standard Error of Mean (logged)	0.308	95% H-UCL (KM -Log)	5.886
KM SD (logged)	0.618	95% Critical H Value (KM-Log)	2.396
KM Standard Error of Mean (logged)	0.308		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	3.54	Mean in Log Scale	1.078
SD in Original Scale	3.067	SD in Log Scale	0.553
95% t UCL (Assumes normality)	5.318	95% H-Stat UCL	5.227

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 6.045

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Naphthalene

General Statistics

Total Number of Observations	10	Number of Distinct Observations	6
Number of Detects	5	Number of Non-Detects	5
Number of Distinct Detects	5	Number of Distinct Non-Detects	1
Minimum Detect	0.03	Minimum Non-Detect	0.1
Maximum Detect	0.26	Maximum Non-Detect	0.1
Variance Detects	0.00828	Percent Non-Detects	50%
Mean Detects	0.103	SD Detects	0.091
Median Detects	0.079	CV Detects	0.882
Skewness Detects	1.836	Kurtosis Detects	3.657
Mean of Logged Detects	-2.539	SD of Logged Detects	0.798

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.799	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.34	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.0836	KM Standard Error of Mean	0.0242
KM SD	0.0632	95% KM (BCA) UCL	0.124
95% KM (t) UCL	0.128	95% KM (Percentile Bootstrap) UCL	0.124
95% KM (z) UCL	0.123	95% KM Bootstrap t UCL	0.156
90% KM Chebyshev UCL	0.156	95% KM Chebyshev UCL	0.189
97.5% KM Chebyshev UCL	0.235	99% KM Chebyshev UCL	0.324

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.32	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.684	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.257	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.36	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	2.019	k star (bias corrected MLE)	0.941
Theta hat (MLE)	0.0511	Theta star (bias corrected MLE)	0.11
nu hat (MLE)	20.19	nu star (bias corrected)	9.408
Mean (detects)	0.103		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0142	Mean	0.0853
Maximum	0.26	Median	0.0709
SD	0.0704	CV	0.825
k hat (MLE)	1.941	k star (bias corrected MLE)	1.425
Theta hat (MLE)	0.044	Theta star (bias corrected MLE)	0.0599
nu hat (MLE)	38.82	nu star (bias corrected)	28.5
Adjusted Level of Significance (β)	0.0267		
Approximate Chi Square Value (28.50, α)	17.32	Adjusted Chi Square Value (28.50, β)	15.82
95% Gamma Approximate UCL (use when n>=50)	0.14	95% Gamma Adjusted UCL (use when n<50)	0.154

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.0836	SD (KM)	0.0632
Variance (KM)	0.004	SE of Mean (KM)	0.0242
k hat (KM)	1.748	k star (KM)	1.29
nu hat (KM)	34.96	nu star (KM)	25.81
theta hat (KM)	0.0478	theta star (KM)	0.0648
80% gamma percentile (KM)	0.131	90% gamma percentile (KM)	0.181
95% gamma percentile (KM)	0.229	99% gamma percentile (KM)	0.34

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (25.81, α)	15.23	Adjusted Chi Square Value (25.81, β)	13.84
95% Gamma Approximate KM-UCL (use when n>=50)	0.142	95% Gamma Adjusted KM-UCL (use when n<50)	0.156

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.972	**Shapiro Wilk GOF Test**

5% Shapiro Wilk Critical Value	0.762	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.214	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.0845	Mean in Log Scale	-2.686
SD in Original Scale	0.0677	SD in Log Scale	0.661
95% t UCL (assumes normality of ROS data)	0.124	95% Percentile Bootstrap UCL	0.119
95% BCA Bootstrap UCL	0.132	95% Bootstrap t UCL	0.164
95% H-UCL (Log ROS)	0.146		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-2.688	KM Geo Mean	0.068
KM SD (logged)	0.611	95% Critical H Value (KM-Log)	2.385
KM Standard Error of Mean (logged)	0.272	95% H-UCL (KM -Log)	0.133
KM SD (logged)	0.611	95% Critical H Value (KM-Log)	2.385
KM Standard Error of Mean (logged)	0.272		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.0766	Mean in Log Scale	-2.767
SD in Original Scale	0.0668	SD in Log Scale	0.584
95% t UCL (Assumes normality)	0.115	95% H-Stat UCL	0.118

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 0.128

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Chromium

General Statistics

Total Number of Observations	10	Number of Distinct Observations	10
		Number of Missing Observations	0
Minimum	0.48	Mean	70.52
Maximum	622	Median	1.4
SD	194.4	Std. Error of Mean	61.46
Coefficient of Variation	2.756	Skewness	3.128

Normal GOF Test

Shapiro Wilk Test Statistic	0.418	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.842	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.466	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.262	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	183.2	95% Adjusted-CLT UCL (Chen-1995)	236.6
		95% Modified-t UCL (Johnson-1978)	193.3

Gamma GOF Test

A-D Test Statistic	1.528	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.834	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.363	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.291	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.251	k star (bias corrected MLE)	0.242
Theta hat (MLE)	281.5	Theta star (bias corrected MLE)	291.4
nu hat (MLE)	5.011	nu star (bias corrected)	4.841
MLE Mean (bias corrected)	70.52	MLE Sd (bias corrected)	143.3
		Approximate Chi Square Value (0.05)	1.079
Adjusted Level of Significance	0.0267	Adjusted Chi Square Value	0.807

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	316.3	95% Adjusted Gamma UCL (use when n<50)	423.2

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.803	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.842	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.286	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.262	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-0.734	Mean of logged Data	1.422
Maximum of Logged Data	6.433	SD of logged Data	2.335

Assuming Lognormal Distribution

95% H-UCL	7972	90% Chebyshev (MVUE) UCL	105.9
95% Chebyshev (MVUE) UCL	138.8	97.5% Chebyshev (MVUE) UCL	184.5
99% Chebyshev (MVUE) UCL	274.4		

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	171.6	95% Jackknife UCL	183.2
95% Standard Bootstrap UCL	167.5	95% Bootstrap-t UCL	1214
95% Hall's Bootstrap UCL	1220	95% Percentile Bootstrap UCL	191.1
95% BCA Bootstrap UCL	249.6		
90% Chebyshev(Mean, Sd) UCL	254.9	95% Chebyshev(Mean, Sd) UCL	338.4
97.5% Chebyshev(Mean, Sd) UCL	454.3	99% Chebyshev(Mean, Sd) UCL	682

Suggested UCL to Use

99% Chebyshev (Mean, Sd) UCL 682

Recommended UCL exceeds the maximum observation

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Cobalt

General Statistics

Total Number of Observations	10	Number of Distinct Observations	6
Number of Detects	5	Number of Non-Detects	5
Number of Distinct Detects	5	Number of Distinct Non-Detects	1
Minimum Detect	1.2	Minimum Non-Detect	1
Maximum Detect	19.5	Maximum Non-Detect	1
Variance Detects	59.94	Percent Non-Detects	50%
Mean Detects	5.8	SD Detects	7.742
Median Detects	3.3	CV Detects	1.335
Skewness Detects	2.117	Kurtosis Detects	4.575
Mean of Logged Detects	1.183	SD of Logged Detects	1.125

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.677	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.407	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	3.4	KM Standard Error of Mean	1.928
KM SD	5.453	95% KM (BCA) UCL	6.82
95% KM (t) UCL	6.934	95% KM (Percentile Bootstrap) UCL	6.84
95% KM (z) UCL	6.571	95% KM Bootstrap t UCL	17.1
90% KM Chebyshev UCL	9.184	95% KM Chebyshev UCL	11.8
97.5% KM Chebyshev UCL	15.44	99% KM Chebyshev UCL	22.58

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.562	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.691	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.329	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.364	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.004	k star (bias corrected MLE)	0.535
Theta hat (MLE)	5.775	Theta star (bias corrected MLE)	10.84
nu hat (MLE)	10.04	nu star (bias corrected)	5.351
Mean (detects)	5.8		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	2.905
Maximum	19.5	Median	0.605
SD	5.996	CV	2.064
k hat (MLE)	0.255	k star (bias corrected MLE)	0.245
Theta hat (MLE)	11.39	Theta star (bias corrected MLE)	11.85
nu hat (MLE)	5.099	nu star (bias corrected)	4.903
Adjusted Level of Significance (β)	0.0267		
Approximate Chi Square Value (4.90, α)	1.107	Adjusted Chi Square Value (4.90, β)	0.83
95% Gamma Approximate UCL (use when n>=50)	12.86	95% Gamma Adjusted UCL (use when n<50)	17.16

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	3.4	SD (KM)	5.453
Variance (KM)	29.74	SE of Mean (KM)	1.928
k hat (KM)	0.389	k star (KM)	0.339
nu hat (KM)	7.775	nu star (KM)	6.776
theta hat (KM)	8.746	theta star (KM)	10.04
80% gamma percentile (KM)	5.352	90% gamma percentile (KM)	9.866
95% gamma percentile (KM)	14.95	99% gamma percentile (KM)	27.96

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (6.78, α)	2.048	Adjusted Chi Square Value (6.78, β)	1.628

95% Gamma Approximate KM-UCL (use when n>=50)	11.25	95% Gamma Adjusted KM-UCL (use when n<50)	14.15

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.876	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.256	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.343	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	2.976	Mean in Log Scale	-0.544
SD in Original Scale	5.959	SD in Log Scale	2.098
95% t UCL (assumes normality of ROS data)	6.431	95% Percentile Bootstrap UCL	6.565
95% BCA Bootstrap UCL	8.516	95% Bootstrap t UCL	16.07
95% H-UCL (Log ROS)	268.9		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	0.592	KM Geo Mean	1.807
KM SD (logged)	0.925	95% Critical H Value (KM-Log)	2.952
KM Standard Error of Mean (logged)	0.327	95% H-UCL (KM -Log)	6.891
KM SD (logged)	0.925	95% Critical H Value (KM-Log)	2.952
KM Standard Error of Mean (logged)	0.327		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	3.15	Mean in Log Scale	0.245
SD in Original Scale	5.869	SD in Log Scale	1.241
95% t UCL (Assumes normality)	6.552	95% H-Stat UCL	12.34

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Bootstrap t UCL	17.1	usted KM-UCL (use when k<=1 and 15 < n < 50 but k<=1)	14.15

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Iron

General Statistics

Total Number of Observations	10	Number of Distinct Observations	10
		Number of Missing Observations	0
Minimum	173	Mean	5675
Maximum	30100	Median	1034
SD	10211	Std. Error of Mean	3229
Coefficient of Variation	1.799	Skewness	2.053

Normal GOF Test

Shapiro Wilk Test Statistic	0.61	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.842	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.407	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.262	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	11593	95% Adjusted-CLT UCL (Chen-1995)	13226
		95% Modified-t UCL (Johnson-1978)	11943

Gamma GOF Test

A-D Test Statistic	0.884	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.787	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.256	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.283	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.447	k star (bias corrected MLE)	0.379
Theta hat (MLE)	12704	Theta star (bias corrected MLE)	14959
nu hat (MLE)	8.934	nu star (bias corrected)	7.587
MLE Mean (bias corrected)	5675	MLE Sd (bias corrected)	9213
		Approximate Chi Square Value (0.05)	2.498
Adjusted Level of Significance	0.0267	Adjusted Chi Square Value	2.021

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	17234	95% Adjusted Gamma UCL (use when n<50)	21304

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.901	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.842	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.215	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.262	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	5.153	Mean of logged Data	7.196
Maximum of Logged Data	10.31	SD of logged Data	1.771

Assuming Lognormal Distribution

95% H-UCL	111904	90% Chebyshev (MVUE) UCL	13085
95% Chebyshev (MVUE) UCL	16862	97.5% Chebyshev (MVUE) UCL	22103
99% Chebyshev (MVUE) UCL	32399		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	10986	95% Jackknife UCL	11593
95% Standard Bootstrap UCL	10738	95% Bootstrap-t UCL	56389
95% Hall's Bootstrap UCL	44475	95% Percentile Bootstrap UCL	11269
95% BCA Bootstrap UCL	12884		
90% Chebyshev(Mean, Sd) UCL	15361	95% Chebyshev(Mean, Sd) UCL	19749
97.5% Chebyshev(Mean, Sd) UCL	25839	99% Chebyshev(Mean, Sd) UCL	37801

Suggested UCL to Use

95% Adjusted Gamma UCL 21304

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test

When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Lead

General Statistics

Total Number of Observations	10	Number of Distinct Observations	9
Number of Detects	8	Number of Non-Detects	2
Number of Distinct Detects	8	Number of Distinct Non-Detects	1
Minimum Detect	4.9	Minimum Non-Detect	1
Maximum Detect	22.8	Maximum Non-Detect	1
Variance Detects	41.63	Percent Non-Detects	20%
Mean Detects	10.15	SD Detects	6.452
Median Detects	7.65	CV Detects	0.636
Skewness Detects	1.503	Kurtosis Detects	1.062
Mean of Logged Detects	2.174	SD of Logged Detects	0.542

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.753	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.386	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	8.32	KM Standard Error of Mean	2.205
KM SD	6.522	95% KM (BCA) UCL	11.99
95% KM (t) UCL	12.36	95% KM (Percentile Bootstrap) UCL	11.82
95% KM (z) UCL	11.95	95% KM Bootstrap t UCL	16.1
90% KM Chebyshev UCL	14.93	95% KM Chebyshev UCL	17.93
97.5% KM Chebyshev UCL	22.09	99% KM Chebyshev UCL	30.26

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.812	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.72	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.361	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.296	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	3.649	k star (bias corrected MLE)	2.364
Theta hat (MLE)	2.781	Theta star (bias corrected MLE)	4.293
nu hat (MLE)	58.39	nu star (bias corrected)	37.83
Mean (detects)	10.15		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	8.122
Maximum	22.8	Median	7.4
SD	7.117	CV	0.876
k hat (MLE)	0.498	k star (bias corrected MLE)	0.415
Theta hat (MLE)	16.31	Theta star (bias corrected MLE)	19.56
nu hat (MLE)	9.96	nu star (bias corrected)	8.306
Adjusted Level of Significance (β)	0.0267		
Approximate Chi Square Value (8.31, α)	2.913	Adjusted Chi Square Value (8.31, β)	2.387
95% Gamma Approximate UCL (use when n>=50)	23.16	95% Gamma Adjusted UCL (use when n<50)	28.26

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	8.32	SD (KM)	6.522
Variance (KM)	42.53	SE of Mean (KM)	2.205
k hat (KM)	1.627	k star (KM)	1.206
nu hat (KM)	32.55	nu star (KM)	24.12
theta hat (KM)	5.112	theta star (KM)	6.899
80% gamma percentile (KM)	13.17	90% gamma percentile (KM)	18.29
95% gamma percentile (KM)	23.34	99% gamma percentile (KM)	34.92

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (24.12, α)	13.94	Adjusted Chi Square Value (24.12, β)	12.61
95% Gamma Approximate KM-UCL (use when n>=50)	14.4	95% Gamma Adjusted KM-UCL (use when n<50)	15.91

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.848	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.818	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.329	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.283	Detected Data Not Lognormal at 5% Significance Level	

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	8.615	Mean in Log Scale	1.918
SD in Original Scale	6.549	SD in Log Scale	0.725
95% t UCL (assumes normality of ROS data)	12.41	95% Percentile Bootstrap UCL	12.12
95% BCA Bootstrap UCL	12.64	95% Bootstrap t UCL	17.3
95% H-UCL (Log ROS)	16.49		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	1.739	KM Geo Mean	5.694
KM SD (logged)	0.981	95% Critical H Value (KM-Log)	3.064
KM Standard Error of Mean (logged)	0.332	95% H-UCL (KM -Log)	25.07
KM SD (logged)	0.981	95% Critical H Value (KM-Log)	3.064
KM Standard Error of Mean (logged)	0.332		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	8.22	Mean in Log Scale	1.601
SD in Original Scale	6.995	SD in Log Scale	1.3
95% t UCL (Assumes normality)	12.27	95% H-Stat UCL	58.6

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

KM H-UCL 25.07

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Manganese

General Statistics

Total Number of Observations	10	Number of Distinct Observations	10
		Number of Missing Observations	0
Minimum	54.2	Mean	1267
Maximum	4370	Median	312.5
SD	1674	Std. Error of Mean	529.3
Coefficient of Variation	1.322	Skewness	1.153

Normal GOF Test

Shapiro Wilk Test Statistic	0.725	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.842	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.352	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.262	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	2237	95% Adjusted-CLT UCL (Chen-1995)	2344
		95% Modified-t UCL (Johnson-1978)	2269

Gamma GOF Test

A-D Test Statistic	0.681	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.769	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.25	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.279	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.6	k star (bias corrected MLE)	0.487
Theta hat (MLE)	2111	Theta star (bias corrected MLE)	2603
nu hat (MLE)	12	nu star (bias corrected)	9.732
MLE Mean (bias corrected)	1267	MLE Sd (bias corrected)	1816
		Approximate Chi Square Value (0.05)	3.775
Adjusted Level of Significance	0.0267	Adjusted Chi Square Value	3.157

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	3265	95% Adjusted Gamma UCL (use when n<50)	3904

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.907	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.842	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.178	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.262	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	3.993	Mean of logged Data	6.114
Maximum of Logged Data	8.383	SD of logged Data	1.613

Assuming Lognormal Distribution

95% H-UCL	18390	90% Chebyshev (MVUE) UCL	3441
95% Chebyshev (MVUE) UCL	4402	97.5% Chebyshev (MVUE) UCL	5737
99% Chebyshev (MVUE) UCL	8359		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	2137	95% Jackknife UCL	2237
95% Standard Bootstrap UCL	2130	95% Bootstrap-t UCL	2641
95% Hall's Bootstrap UCL	1874	95% Percentile Bootstrap UCL	2134
95% BCA Bootstrap UCL	2245		
90% Chebyshev(Mean, Sd) UCL	2855	95% Chebyshev(Mean, Sd) UCL	3574
97.5% Chebyshev(Mean, Sd) UCL	4572	99% Chebyshev(Mean, Sd) UCL	6533

Suggested UCL to Use

95% Adjusted Gamma UCL 3904

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Nickel

General Statistics

Total Number of Observations	10	Number of Distinct Observations	9
Number of Detects	9	Number of Non-Detects	1
Number of Distinct Detects	8	Number of Distinct Non-Detects	1
Minimum Detect	1.1	Minimum Non-Detect	1
Maximum Detect	1260	Maximum Non-Detect	1
Variance Detects	173842	Percent Non-Detects	10%
Mean Detects	148.7	SD Detects	416.9
Median Detects	2.4	CV Detects	2.804
Skewness Detects	2.994	Kurtosis Detects	8.974
Mean of Logged Detects	1.94	SD of Logged Detects	2.388

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.414	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.497	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	133.9	KM Standard Error of Mean	126
KM SD	375.5	95% KM (BCA) UCL	383.2
95% KM (t) UCL	364.8	95% KM (Percentile Bootstrap) UCL	382.2
95% KM (z) UCL	341.1	95% KM Bootstrap t UCL	5762
90% KM Chebyshev UCL	511.8	95% KM Chebyshev UCL	683
97.5% KM Chebyshev UCL	920.6	99% KM Chebyshev UCL	1387

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.45	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.834	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.338	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.306	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.234	k star (bias corrected MLE)	0.23
Theta hat (MLE)	634.5	Theta star (bias corrected MLE)	645.6
nu hat (MLE)	4.219	nu star (bias corrected)	4.146
Mean (detects)	148.7		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	133.8
Maximum	1260	Median	1.85
SD	395.9	CV	2.958
k hat (MLE)	0.203	k star (bias corrected MLE)	0.209
Theta hat (MLE)	658.4	Theta star (bias corrected MLE)	640.5
nu hat (MLE)	4.065	nu star (bias corrected)	4.179
Adjusted Level of Significance (β)	0.0267		
Approximate Chi Square Value (4.18, α)	0.794	Adjusted Chi Square Value (4.18, β)	0.576
95% Gamma Approximate UCL (use when n>=50)	704.7	95% Gamma Adjusted UCL (use when n<50)	971.9

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	133.9	SD (KM)	375.5
Variance (KM)	141037	SE of Mean (KM)	126
k hat (KM)	0.127	k star (KM)	0.156
nu hat (KM)	2.544	nu star (KM)	3.114
theta hat (KM)	1053	theta star (KM)	860.2
80% gamma percentile (KM)	150.2	90% gamma percentile (KM)	399.1
95% gamma percentile (KM)	731.7	99% gamma percentile (KM)	1690

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (3.11, α)	0.407	Adjusted Chi Square Value (3.11, β)	0.28
95% Gamma Approximate KM-UCL (use when n>=50)	1025	95% Gamma Adjusted KM-UCL (use when n<50)	1490

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.804	**Shapiro Wilk GOF Test**

5% Shapiro Wilk Critical Value	0.829	Detected Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.228	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	133.8	Mean in Log Scale	1.39
SD in Original Scale	395.9	SD in Log Scale	2.844
95% t UCL (assumes normality of ROS data)	363.3	95% Percentile Bootstrap UCL	382.5
95% BCA Bootstrap UCL	510.4	95% Bootstrap t UCL	5758
95% H-UCL (Log ROS)	274790		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	1.746	KM Geo Mean	5.732
KM SD (logged)	2.214	95% Critical H Value (KM-Log)	5.916
KM Standard Error of Mean (logged)	0.742	95% H-UCL (KM -Log)	5224
KM SD (logged)	2.214	95% Critical H Value (KM-Log)	5.916
KM Standard Error of Mean (logged)	0.742		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	133.9	Mean in Log Scale	1.677
SD in Original Scale	395.9	SD in Log Scale	2.4
95% t UCL (Assumes normality)	363.4	95% H-Stat UCL	15641

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

99% KM (Chebyshev) UCL 1387

Warning: Recommended UCL exceeds the maximum observation

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Appendix D

Appendix D

Shower Model – Input Assumptions and Estimated Air Concentrations

Appendix D Contents
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

TABLE D-1
VALUES USED FOR SHOWER MODEL
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

Scenario Timeframe:	Current/Future
Medium:	Groundwater
Exposure Medium:	Air
Receptor Population:	Resident
Receptor Age:	Adult

Exposure Route	Parameter Code	Parameter Definition	Unit	Reasonable Maximum Exposure		Central Tendency Exposure		Intake Equation/ Model Name
				Value	Reference	Value	Reference	
Inhalation	CW	Chemical Concentration in Water	µg/L	Table B-3.3	Table B-3.3	Table B-3.3	Table B-3.3	Maximum air concentration in bathroom
	f	Fraction volatilized	--	chem-specific	Schaum et al. (1)	chem-specific	Schaum et al. (1)	(C_{aMax}) (µg/m^3) =
	F_w	Flow Rate	L/hr	1000	Schaum et al.	500	Schaum et al.	CW x f x Fw x t_1 x 1/Va
	t_1	Time of shower	hr	0.50	EPA 2011(2)	0.23	EPA 2011(3)	
	V_a	Bathroom volume	m^3	6	Schaum et al.	16	Schaum et al.	EPC (µg/m^3) =
	t_2	Time after shower in bathroom	hr	0.33	EPA 2011(2)	0.08	EPA 2011(3)	(((C_{aMax}2) x t_1) + (C_{aMax} x t_2)) / (t_1 + t_2)

EPC = Exposure Point Concentration, the average air concentration in the bathroom during and after shower
µg = microgram
L = liter
hr = hour
m = meter
Note:
(1) applies only to volatile chemicals
(2) based on the weighted average of 90th percentile duration of shower and duration in shower immediately following a shower (Table 16-32)
(3) based on the weighted average of 50th percentile duration of shower and duration in shower immediately following a shower (Table 16-32)
Sources:
EPA 2011. Exposure Factors Handbook: 2011 Edition. EPA/600/R-090/052F. September.
Schaum *et al* . 1994. *Estimating Dermal and Inhalation Exposure to Volatile Chemicals in Domestic Water* . Water Contamination and Health, edited by Rhoda G.M. Wang. New York: Marcel Dekker, Inc.

TABLE D-2
VALUES USED FOR SHOWER MODEL
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

Scenario Timeframe:	Current/Future
Medium:	Groundwater
Exposure Medium:	Air
Receptor Population:	Resident
Receptor Age:	Child (0 to <6 years)

Exposure Route	Parameter Code	Parameter Definition	Unit	Reasonable Maximum Exposure		Central Tendency Exposure		Intake Equation/ Model Name
				Value	Reference	Value	Reference	
Inhalation	CW	Chemical Concentration in Water	µg/L	Table B-3.3	Table B-3.3	Table B-3.3	Table B-3.3	Maximum air concentration in bathroom
	f	Fraction volatilized	--	chem-specific	Schaum et al. (1)	chem-specific	Schaum et al. (1)	(C_{aMax}) (µg/m^3) =
	F_w	Flow Rate	L/hr	1000	Schaum et al.	500	Schaum et al.	CW x f x Fw x t_1 x 1/Va
	t_1	Time of shower	hr	0.50	EPA 2011(2)	0.30	EPA 2011(3)	
	V_a	Bathroom volume	m^3	6	Schaum et al.	16	Schaum et al.	EPC (µg/m^3) =
	t_2	Time after shower in bathroom	hr	0.23	EPA 2011(2)	0.1	EPA 2011(3)	(((C_{aMax}/2) x t_1) + (C_{aMax} x t_2)) / (t_1 + t_2)

EPC = Exposure Point Concentration, the average air concentration in the bathroom during and after shower
µg = microgram
L = liter
hr = hour
m = meter
Note:
(1) applies only to volatile chemicals
(2) based on the weighted average of 90th percentile duration of shower and duration in shower immediately following a shower (Table 16-29)
(3) based on the weighted average of mean duration of shower and duration in shower immediately following a shower (Table 16-29)
Sources:
EPA 2011. Exposure Factors Handbook: 2011 Edition. EPA/600/R-090/052F. September.
Schaum *et al*. 1994. *Estimating Dermal and Inhalation Exposure to Volatile Chemicals in Domestic Water*. Water Contamination and Health, edited by Rhoda G.M. Wang. New York: Marcel Dekker, Inc.

TABLE D-3

MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY

Mansfield Trail Dump Site, OU1

Byram Township, New Jersey

Scenario Timeframe:	Current/Future
Medium:	Groundwater
Exposure Medium:	Air
Receptor Population:	Resident
Receptor Age:	Adult

Exposure Point	CAS No.	Chemical of Potential Concern	Groundwater Exposure Point Concentration (EPC) (µg/L)	Fraction Volatilized	Reasonable Maximum Exposure		Central Tendency Exposure	
					C_{aMax} (µg/m^3)	Air EPC (µg/m^3)	C_{aMax} (µg/m^3)	Air EPC (µg/m^3)
Water Vapor at		**Volatile Organic Compounds**						
	79-34-5	1,1,2,2-Tetrachloroethane	2.40E-01	4.9E-01	9.9E+00	6.9E+00	8.5E-01	5.4E-01
Showerhead	75-34-3	1,1-Dichloroethane	2.71E+01	5.4E-01	1.2E+03	8.5E+02	1.1E+02	6.6E+01
	87-61-6	1,2,3-Trichlorobenzene	8.50E+00	4.6E-01	3.3E+02	2.3E+02	2.8E+01	1.8E+01
	107-06-2	1,2-Dichloroethane	2.87E-01	5.5E-01	1.3E+01	9.2E+00	1.1E+00	7.2E-01
	106-46-7	1,4-Dichlorobenzene	1.02E+01	4.7E-01	4.0E+02	2.8E+02	3.5E+01	2.2E+01
	71-43-2	Benzene	8.15E-01	5.3E-01	3.6E+01	2.5E+01	3.1E+00	1.9E+00
	75-27-4	Bromodichloromethane	4.69E-01	5.4E-01	2.1E+01	1.5E+01	1.8E+00	1.2E+00
	108-90-7	Chlorobenzene	3.15E+01	5.0E-01	1.3E+03	9.2E+02	1.1E+02	7.1E+01
	67-66-3	Chloroform	3.33E+00	5.5E-01	1.5E+02	1.1E+02	1.3E+01	8.3E+00
	156-59-2	cis-1,2-Dichloroethene	5.31E+01	5.6E-01	2.5E+03	1.7E+03	2.1E+02	1.4E+02
	79-01-6	Trichloroethene	1.84E+02	5.3E-01	8.1E+03	5.6E+03	7.0E+02	4.4E+02
	75-01-4	Vinyl Chloride	1.97E+01	5.9E-01	9.6E+02	6.7E+02	8.3E+01	5.2E+01

EPC = Exposure Point Concentration, the average air concentration in the bathroom during and after shower

µg/L = microgram per liter

µg/m^3 = microgram per cubic meter

TABLE D-4

MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY

Mansfield Trail Dump Site, OU1

Byram Township, New Jersey

Scenario Timeframe:	Current/Future
Medium:	Groundwater
Exposure Medium:	Air
Receptor Population:	Resident
Receptor Age:	Child (0 to <6 years)

Exposure Point	CAS No.	Chemical of Potential Concern	Groundwater Exposure Point Concentration (EPC) (µg/L)	Fraction Volatilized	Reasonable Maximum Exposure		Central Tendency Exposure	
					C_{aMax} (µg/m^3)	Air EPC (µg/m^3)	C_{aMax} (µg/m^3)	Air EPC (µg/m^3)
Water Vapor at		**Volatile Organic Compounds**						
	79-34-5	1,1,2,2-Tetrachloroethane	2.40E-01	4.9E-01	9.9E+00	6.5E+00	1.1E+00	6.9E-01
Showerhead	75-34-3	1,1-Dichloroethane	2.71E+01	5.4E-01	1.2E+03	8.0E+02	1.4E+02	8.6E+01
	87-61-6	1,2,3-Trichlorobenzene	8.50E+00	4.6E-01	3.3E+02	2.1E+02	3.7E+01	2.3E+01
	107-06-2	1,2-Dichloroethane	2.87E-01	5.5E-01	1.3E+01	8.7E+00	1.5E+00	9.3E-01
	106-46-7	1,4-Dichlorobenzene	1.02E+01	4.7E-01	4.0E+02	2.6E+02	4.5E+01	2.8E+01
	71-43-2	Benzene	8.15E-01	5.3E-01	3.6E+01	2.4E+01	4.0E+00	2.5E+00
	75-27-4	Bromodichloromethane	4.69E-01	5.4E-01	2.1E+01	1.4E+01	2.4E+00	1.5E+00
	108-90-7	Chlorobenzene	3.15E+01	5.0E-01	1.3E+03	8.6E+02	1.5E+02	9.2E+01
	67-66-3	Chloroform	3.33E+00	5.5E-01	1.5E+02	1.0E+02	1.7E+01	1.1E+01
	156-59-2	cis-1,2-Dichloroethene	5.31E+01	5.6E-01	2.5E+03	1.6E+03	2.8E+02	1.8E+02
	79-01-6	Trichloroethene	1.84E+02	5.3E-01	8.1E+03	5.3E+03	9.1E+02	5.7E+02
	75-01-4	Vinyl Chloride	1.97E+01	5.9E-01	9.6E+02	6.3E+02	1.1E+02	6.8E+01

EPC = Exposure Point Concentration, the average air concentration in the bathroom during and after shower

µg/L = microgram per liter

µg/m^3 = microgram per cubic meter

Appendix E

Appendix E
IEUBK Model Results

LEAD MODEL FOR WINDOWS Version 1.1

==========

Model Version: 1.1 Build11
User Name:
Date:
Site Name:
Operable Unit:
Run Mode: Research

==========

****** Air ******

Indoor Air Pb Concentration: 30.000 percent of outdoor.
Other Air Parameters:

Age	Time Outdoors (hours)	Ventilation Rate (m^3/day)	Lung Absorption (%)	Outdoor Air Pb Conc (µg Pb/m^3)
.5-1	1.000	2.000	32.000	0.100
1-2	2.000	3.000	32.000	0.100
2-3	3.000	5.000	32.000	0.100
3-4	4.000	5.000	32.000	0.100
4-5	4.000	5.000	32.000	0.100
5-6	4.000	7.000	32.000	0.100
6-7	4.000	7.000	32.000	0.100

****** Diet ******

Age	Diet Intake(µg/day)
.5-1	2.260
1-2	1.960
2-3	2.130
3-4	2.040
4-5	1.950
5-6	2.050
6-7	2.220

****** Drinking Water ******

Water Consumption:

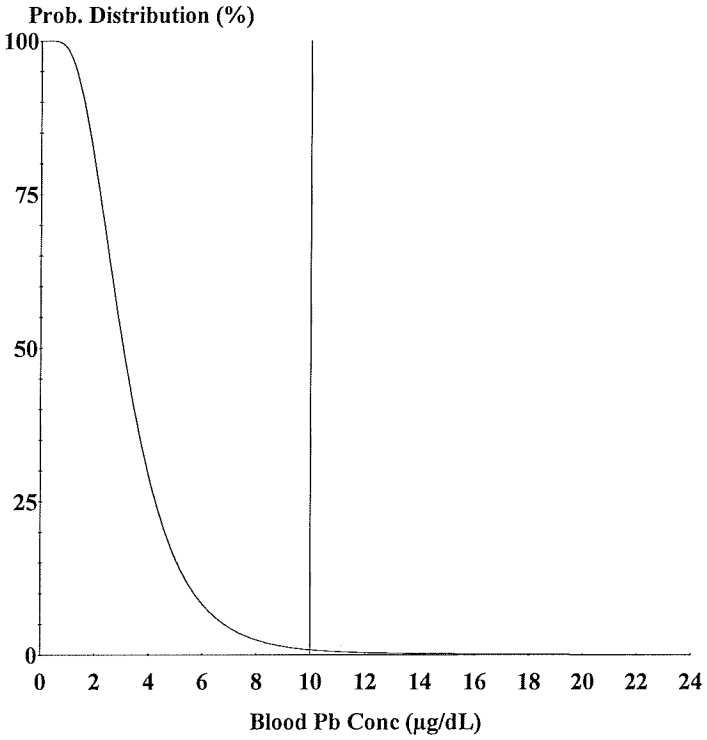
Age	Water (L/day)
.5-1	0.200
1-2	0.500
2-3	0.520
3-4	0.530
4-5	0.550
5-6	0.580
6-7	0.590

Drinking Water Concentration: 10.200 µg Pb/L

****** Soil & Dust ******

Multiple Source Analysis Used
Average multiple source concentration: 150.000 µg/g

Mass fraction of outdoor soil to indoor dust conversion factor: 0.700
Outdoor airborne lead to indoor household dust lead concentration: 100.000
Use alternate indoor dust Pb sources? No



Cutoff = 10.000 µg/dl
Geo Mean = 3.195
GSD = 1.600
% Above = 0.760

Age Range = 0 to 84 months

Run Mode = Research

Appendix F

Appendix F

RAGS D Tables – Central Tendency Exposure Scenario

Appendix F Contents
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

[(1)] Noncancer hazards presented for the child receptor (birth to <6 years); cancer risks presented for the lifetime receptor.

[(2)] Noncancer hazards presented for the adult receptor; cancer risks presented for the lifetime receptor.

TABLE F-7.0
CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS - TRICHLOROETHYLENE
GROUNDWATER FOR CURRENT/FUTURE RESIDENT
CENTRAL TENDENCY EXPOSURE
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

Common Exposure Parameters

Groundwater Concentration (CW)	184	µg/L	
Exposure Frequency	350	days	
Permeability Coefficient	0.012	cm/hr	(Table B-4.2)
Fraction Absorbed Water	1		(Table B-4.2)
Lag time	0.58	hr/day	(Table B-4.2)
Exposure Time - child	0.38	hr/day	(Table B-4.1a)
Exposure Time - adult	0.36	hr/day	(Table B-4.1a)

Ingestion

	Exposure Parameters					Cancer Risk Calculations						
C1	*C2*	*C3*	*C4*	*C5*	*C6*	*C7*	*C8*	*C9*	*C10*	*C11*	*C12*	*C13*
Unit	kg	L/day	mg/L	yr	-	$(mg/kg/d)^{-1}$	-	-	$(mg/kg/d)^{-1}$	$(mg/kg/d)^{-1}$	-	-
Equation	-	-	CW/1000	-	*(C5 / 70 yr x EF / 365 days)*	-	-	*(C3 x C4 x C6 x C7 x C8 / C2)*	-	*(C10 – C7)*	*(C3 x C4 x C6 x C11 / C2)*	*(C9 + C12)*
Age group	Body Weight	Ingestion Rate	Exposure Concentration	Age Group Duration	Duration Adjustment	Kidney Slope Factor	Kidney Cancer ADAF	**Kidney ADAF-Adjusted Partial Risk**	Kidney+NHL+ Liver Slope Factor	NHL+Liver Slope Factor	**NHL+Liver Partial Risk**	**Total Partial Risk**
0 to <2 years	15	0.39	0.184	2	2.7E-02	9.3E-03	10	**1.2E-05**	4.6E-02	3.7E-02	**4.8E-06**	**1.7E-05**
2 to <6 years	15	0.39	0.184	4	5.5E-02	9.3E-03	3	**7.3E-06**	4.6E-02	3.7E-02	**9.6E-06**	**1.7E-05**
18 to <21 years	80	1	0.184	3	4.1E-02	9.3E-03	1	**8.8E-07**	4.6E-02	3.7E-02	**3.5E-06**	**4.4E-06**
										Total Ingestion Risk		**3.8E-05**

Dermal Contact

	Exposure Parameters					Cancer Risk Calculations						
C1	*C2*	*C3*	*C4*	*C5*	*C6*	*C7*	*C8*	*C9*	*C10*	*C11*	*C12*	*C13*
Unit	kg	cm^2/day	mg/cm^2	yr	-	$(mg/kg/d)^{-1}$	-	-	$(mg/kg/d)^{-1}$	$(mg/kg/d)^{-1}$	-	-
Equation	-	-	*Table B-4.5*	-	*(C5 / 70 yr x EF / 365 days)*	-	-	*(C3 x C4 x C6 x C7 x C8 / C2)*	-	*(C10 – C7)*	*(C3 x C4 x C6 x C11 / C2)*	*(C9 + C12)*
Age group	Body Weight	Skin Surface Area	Dermal Absorbed (DA_{event})	Age Group Duration	Duration Adjustment	Kidney Slope Factor	Kidney Cancer ADAF	**Kidney ADAF-Adjusted Partial Risk**	Kidney+NHL+ Liver Slope Factor	NHL+Liver Slope Factor	**NHL+Liver Partial Risk**	**Total Partial Risk**
0 to <2 years	15	6,378	2.9E-06	2	2.7E-02	9.3E-03	10	**3.1E-06**	4.6E-02	3.7E-02	**1.2E-06**	**4.3E-06**
2 to <6 years	15	6,378	2.9E-06	4	5.5E-02	9.3E-03	3	**1.9E-06**	4.6E-02	3.7E-02	**2.5E-06**	**4.3E-06**
18 to <21 years	80	20,900	2.8E-06	3	4.1E-02	9.3E-03	1	**2.8E-07**	4.6E-02	3.7E-02	**1.1E-06**	**1.4E-06**
										Total Dermal Risk		**1.0E-05**

TABLE F-7.0
CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS - TRICHLOROETHYLENE
GROUNDWATER FOR CURRENT/FUTURE RESIDENT
CENTRAL TENDENCY EXPOSURE
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

Inhalation of Volatile Chemicals

	Exposure Parameters					Cancer Risk Calculations						
C1	*C2*	*C3*	*C4*	*C5*	*C6*	*C7*	*C8*	*C9*	*C10*	*C11*	*C12*	*C13*
Unit	hr/day	µg/m^3	µg/m^3	yr	-	(µg/m^3)$^{-1}$	-	-	(µg/m^3)$^{-1}$	(µg/m^3)$^{-1}$	-	-
Equation	-	Table D-3/D-4	*C3*	-	*(C5 / 70 yr x C2 / 24 hrs x EF / 365 days)*	-	-	*(C4 x C6 x C7 x C8)*	-	*(C10 – C7)*	*(C4 x C6 x C11)*	*(C9 + C12)*
Age group	Exposure Time	Chemical Concentration in Air	Exposure Concentration	Age Group Duration	Duration Adjustment	Kidney Unit Risk	Kidney Cancer ADAF	**Kidney ADAF-Adjusted Partial Risk**	Kidney+NHL+ Liver Unit Risk	NHL+Liver Unit Risk	**NHL+Liver Partial Risk**	**Total Partial Risk**
0 to <2 years	0.38	5.3E+03	5.3E+03	2	4.3E-04	1.0E-06	10	**2.3E-05**	4.1E-06	3.1E-06	**7.1E-06**	**3.0E-05**
2 to <6 years	0.38	5.3E+03	5.3E+03	4	8.7E-04	1.0E-06	3	**1.4E-05**	4.1E-06	3.1E-06	**1.4E-05**	**2.8E-05**
18 to <21 years	0.36	5.6E+03	5.6E+03	3	6.2E-04	1.0E-06	1	**3.5E-06**	4.1E-06	3.1E-06	**1.1E-05**	**1.4E-05**
											Total Inhalation Risk	**7.2E-05**

ADAF = age-dependent adjustment factors

Source:
EPA 2011. Toxicological Review of Trichloroethylene (CAS No. 79-01-6) in Support of Summary Information on the Integrated Risk Information System (IRIS). September.

TABLE F-7.1
CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS
CENTRAL TENDENCY EXPOSURE
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Resident
Receptor Age:	Child/Lifetime[1]

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	Exposure Point Concentration		Cancer Risk Calculation					Noncancer Hazard Calculation				
							Intake/ Exposure Concentration		Slope Factor/Unit Risk		Cancer	Intake/ Exposure Concentration		RfD/RfC		Hazard
					Value	Unit	Value	Unit	Value	Unit	Risk	Value	Unit	Value	Unit	Quotient
Groundwater	Groundwater	Tap Water	Ingestion	**Volatile Organic Compounds**												
				1,1,2,2-Tetrachloroethane	2.40E-01	µg/L	6.36E-07	mg/kg-day	2.0E-01	$(mg/kg-day)^{-1}$	1.27E-07	5.98E-06	mg/kg-day	2.0E-02	mg/kg-day	2.99E-04
				1,1-Dichloroethane	2.71E+01	µg/L	7.18E-05	mg/kg-day	5.7E-03	$(mg/kg-day)^{-1}$	4.09E-07	6.75E-04	mg/kg-day	2.0E-01	mg/kg-day	3.38E-03
				1,2,3-Trichlorobenzene	8.50E+00	µg/L	2.25E-05	mg/kg-day	NA	NA	NA	2.12E-04	mg/kg-day	8.0E-04	mg/kg-day	2.65E-01
				1,2-Dichloroethane	2.87E-01	µg/L	7.61E-07	mg/kg-day	9.1E-02	$(mg/kg-day)^{-1}$	6.92E-08	7.16E-06	mg/kg-day	6.0E-03	mg/kg-day	1.19E-03
				1,4-Dichlorobenzene	1.02E+01	µg/L	2.70E-05	mg/kg-day	5.4E-03	$(mg/kg-day)^{-1}$	1.46E-07	2.54E-04	mg/kg-day	7.0E-02	mg/kg-day	3.63E-03
				Benzene	8.15E-01	µg/L	2.16E-06	mg/kg-day	5.5E-02	$(mg/kg-day)^{-1}$	1.19E-07	2.03E-05	mg/kg-day	4.0E-03	mg/kg-day	5.08E-03
				Bromodichloromethane	4.69E-01	µg/L	1.24E-06	mg/kg-day	6.2E-02	$(mg/kg-day)^{-1}$	7.71E-08	1.17E-05	mg/kg-day	2.0E-02	mg/kg-day	5.85E-04
				Chlorobenzene	3.15E+01	µg/L	8.36E-05	mg/kg-day	NA	NA	NA	7.86E-04	mg/kg-day	2.0E-02	mg/kg-day	3.93E-02
				Chloroform	3.33E+00	µg/L	8.82E-06	mg/kg-day	3.1E-02	$(mg/kg-day)^{-1}$	2.73E-07	8.29E-05	mg/kg-day	1.0E-02	mg/kg-day	8.29E-03
				cis-1,2-Dichloroethene	5.31E+01	µg/L	1.41E-04	mg/kg-day	NA	NA	NA	1.32E-03	mg/kg-day	2.0E-03	mg/kg-day	6.62E-01
				Trichloroethene	1.84E+02	µg/L	See Table F-7.0.9	NA	4.6E-02	NA	3.83E-05	4.59E-03	mg/kg-day	5.0E-04	mg/kg-day	9.18E+00
				Vinyl Chloride	1.97E+01	µg/L	5.66E-04	mg/kg-day	7.2E-01	$(mg/kg-day)^{-1}$	4.07E-04	4.92E-04	mg/kg-day	3.0E-03	mg/kg-day	1.64E-01
				Semi-volatile Organic Compounds												
				1,4-Dioxane	2.16E+01	µg/L	5.71E-05	mg/kg-day	1.0E-01	$(mg/kg-day)^{-1}$	5.71E-06	5.37E-04	mg/kg-day	3.0E-02	mg/kg-day	1.79E-02
				2,3,4,6-Tetrachlorophenol	1.10E+02	µg/L	2.92E-04	mg/kg-day	NA	NA	NA	2.74E-03	mg/kg-day	3.0E-02	mg/kg-day	9.14E-02
				Benzo(a)anthracene	3.50E-02	µg/L	4.53E-07	mg/kg-day	7.3E-01	$(mg/kg-day)^{-1}$	3.31E-07	8.73E-07	mg/kg-day	NA	NA	NA
				Benzo(b)fluoranthene	1.50E-01	µg/L	1.94E-06	mg/kg-day	7.3E-01	$(mg/kg-day)^{-1}$	1.42E-06	3.74E-06	mg/kg-day	NA	NA	NA
				Bis(2-Ethylhexyl)Phthalate	6.05E+00	µg/L	1.60E-05	mg/kg-day	1.4E-02	$(mg/kg-day)^{-1}$	2.24E-07	1.51E-04	mg/kg-day	2.0E-02	mg/kg-day	7.54E-03
				Naphthalene	1.28E-01	µg/L	3.39E-07	mg/kg-day	NA	NA	NA	3.19E-06	mg/kg-day	2.0E-02	mg/kg-day	1.60E-04
				Inorganics												
				Antimony	5.20E+00	µg/L	1.38E-05	mg/kg-day	NA	NA	NA	1.30E-04	mg/kg-day	4.0E-04	mg/kg-day	3.24E-01
				Chromium	6.22E+02	µg/L	1.65E-03	mg/kg-day	5.0E-01	$(mg/kg-day)^{-1}$	8.24E-04	1.55E-02	mg/kg-day	3.0E-03	mg/kg-day	5.17E+00
				Cobalt	1.42E+01	µg/L	3.75E-05	mg/kg-day	NA	NA	NA	3.53E-04	mg/kg-day	3.0E-04	mg/kg-day	1.18E+00
				Iron	2.13E+04	µg/L	5.65E-02	mg/kg-day	NA	NA	NA	5.31E-01	mg/kg-day	7.0E-01	mg/kg-day	7.59E-01
				Lead	1.02E+01	µg/L	2.69E-05	mg/kg-day	NA	NA	NA	2.53E-04	mg/kg-day	NA	NA	NA
				Manganese	3.90E+03	µg/L	1.03E-02	mg/kg-day	NA	NA	NA	9.73E-02	mg/kg-day	1.4E-01	mg/kg-day	6.95E-01
				Nickel	1.26E+03	µg/L	3.34E-03	mg/kg-day	NA	NA	NA	3.14E-02	mg/kg-day	2.0E-02	mg/kg-day	1.57E+00
				Thallium	6.30E-02	µg/L	1.67E-07	mg/kg-day	NA	NA	NA	1.57E-06	mg/kg-day	1.0E-05	mg/kg-day	1.57E-01
			Exp. Route Total								1.28E-03					2.03E+01

TABLE F-7.1
CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS
CENTRAL TENDENCY EXPOSURE
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Resident
Receptor Age:	Child/Lifetime[1]

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	Exposure Point Concentration		Cancer Risk Calculation					Noncancer Hazard Calculation				
							Intake/ Exposure Concentration		Slope Factor/Unit Risk		Cancer	Intake/ Exposure Concentration		RfD/RfC		Hazard
					Value	Unit	Value	Unit	Value	Unit	Risk	Value	Unit	Value	Unit	Quotient
Groundwater	Groundwater	Tap Water	Dermal Contact	**Volatile Organic Compounds**												
				1,1,2,2-Tetrachloroethane	2.40E-01	µg/L	1.65E-07	mg/kg-day	2.0E-01	$(mg/kg-day)^{-1}$	3.30E-08	1.47E-06	mg/kg-day	2.0E-02	mg/kg-day	7.37E-05
				1,1-Dichloroethane	2.71E+01	µg/L	1.16E-05	mg/kg-day	5.7E-03	$(mg/kg-day)^{-1}$	6.60E-08	1.03E-04	mg/kg-day	2.0E-01	mg/kg-day	5.16E-04
				1,2,3-Trichlorobenzene	8.50E+00	µg/L	NA	NA	NA	NA	NA	NA	NA	8.0E-04	mg/kg-day	NA
				1,2-Dichloroethane	2.87E-01	µg/L	7.68E-08	mg/kg-day	9.1E-02	$(mg/kg-day)^{-1}$	6.99E-09	6.86E-07	mg/kg-day	6.0E-03	mg/kg-day	1.14E-04
				1,4-Dichlorobenzene	1.02E+01	µg/L	3.73E-05	mg/kg-day	5.4E-03	$(mg/kg-day)^{-1}$	2.01E-07	3.33E-04	mg/kg-day	7.0E-02	mg/kg-day	4.75E-03
				Benzene	8.15E-01	µg/L	6.81E-07	mg/kg-day	5.5E-02	$(mg/kg-day)^{-1}$	3.74E-08	6.08E-06	mg/kg-day	4.0E-03	mg/kg-day	1.52E-03
				Bromodichloromethane	4.69E-01	µg/L	2.09E-07	mg/kg-day	6.2E-02	$(mg/kg-day)^{-1}$	1.30E-08	1.87E-06	mg/kg-day	2.0E-02	mg/kg-day	9.34E-05
				Chlorobenzene	3.15E+01	µg/L	6.19E-05	mg/kg-day	NA	NA	NA	5.53E-04	mg/kg-day	2.0E-02	mg/kg-day	2.76E-02
				Chloroform	3.33E+00	µg/L	1.65E-06	mg/kg-day	3.1E-02	$(mg/kg-day)^{-1}$	5.13E-08	1.48E-05	mg/kg-day	1.0E-02	mg/kg-day	1.48E-03
				cis-1,2-Dichloroethene	5.31E+01	µg/L	NA	NA	NA	NA	NA	NA	NA	2.0E-03	mg/kg-day	NA
				Trichloroethene	1.84E+02	µg/L	See Table F-7.0.9	NA	4.6E-02	$(mg/kg-day)^{-1}$	1.00E-05	1.55E-03	mg/kg-day	5.0E-04	mg/kg-day	3.11E+00
				Vinyl Chloride	1.97E+01	µg/L	5.99E-05	mg/kg-day	7.2E-01	$(mg/kg-day)^{-1}$	4.31E-05	5.19E-05	mg/kg-day	3.0E-03	mg/kg-day	1.73E-02
				Semi-volatile Organic Compounds												
				1,4-Dioxane	2.16E+01	µg/L	4.22E-07	mg/kg-day	1.0E-01	$(mg/kg-day)^{-1}$	4.22E-08	3.77E-06	mg/kg-day	3.0E-02	mg/kg-day	1.26E-04
				2,3,4,6-Tetrachlorophenol	1.10E+02	µg/L	NA	NA	NA	NA	NA	NA	NA	3.0E-02	mg/kg-day	NA
				Benzo(a)anthracene	3.50E-02	µg/L	1.16E-05	mg/kg-day	7.3E-01	$(mg/kg-day)^{-1}$	8.47E-06	2.16E-05	mg/kg-day	NA	NA	NA
				Benzo(b)fluoranthene	1.50E-01	µg/L	8.65E-05	mg/kg-day	7.3E-01	$(mg/kg-day)^{-1}$	6.31E-05	1.61E-04	mg/kg-day	NA	NA	NA
				Bis(2-Ethylhexyl)Phthalate	6.05E+00	µg/L	5.10E-05	mg/kg-day	1.4E-02	$(mg/kg-day)^{-1}$	7.14E-07	4.55E-04	mg/kg-day	2.0E-02	mg/kg-day	2.28E-02
				Naphthalene	1.28E-01	µg/L	4.66E-07	mg/kg-day	NA	NA	NA	4.16E-06	mg/kg-day	2.0E-02	mg/kg-day	2.08E-04
				Inorganics												
				Antimony	5.20E+00	µg/L	1.59E-07	mg/kg-day	NA	NA	NA	1.42E-06	mg/kg-day	6.0E-05	mg/kg-day	2.37E-02
				Chromium	6.22E+02	µg/L	3.81E-05	mg/kg-day	2.0E+01		7.62E-04	3.40E-04	mg/kg-day	7.5E-05	mg/kg-day	4.54E+00
				Cobalt	1.42E+01	µg/L	1.73E-07	mg/kg-day	NA	NA	NA	1.55E-06	mg/kg-day	3.0E-04	mg/kg-day	5.16E-03
				Iron	2.13E+04	µg/L	6.53E-04	mg/kg-day	NA		NA	5.83E-03	mg/kg-day	7.0E-01	mg/kg-day	8.32E-03
				Lead	1.02E+01	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	3.90E+03	µg/L	1.20E-04	mg/kg-day	NA	NA	NA	1.07E-03	mg/kg-day	1.4E-01	mg/kg-day	7.63E-03
				Nickel	1.26E+03	µg/L	7.72E-06	mg/kg-day	NA	$(mg/kg-day)^{-1}$	NA	6.89E-05	mg/kg-day	8.0E-04	mg/kg-day	8.61E-02
				Thallium	6.30E-02	µg/L	1.93E-09	mg/kg-day	NA	$(mg/kg-day)^{-1}$	NA	1.72E-08	mg/kg-day	1.0E-05	mg/kg-day	1.72E-03
			Exp. Route Total								8.88E-04					7.85E+00

TABLE F-7.1
CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS
CENTRAL TENDENCY EXPOSURE
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Resident
Receptor Age:	Child/Lifetime[1]

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	Exposure Point Concentration		Cancer Risk Calculation					Noncancer Hazard Calculation				
							Intake/ Exposure Concentration		Slope Factor/Unit Risk		Cancer	Intake/ Exposure Concentration		RfD/RfC		Hazard
					Value	Unit	Value	Unit	Value	Unit	Risk	Value	Unit	Value	Unit	Quotient
Groundwater	Groundwater	Tap Water	Inhalation	**Volatile Organic Compounds**												
				1,1,2,2-Tetrachloroethane	2.40E-01	µg/L	1.23E-03	µg/m^3	5.8E-05	(µg/m^3)$^{-1}$	7.16E-08	1.05E-05	mg/m^3	NA	mg/m^3	NA
				1,1-Dichloroethane	2.71E+01	µg/L	1.52E-01	µg/m^3	1.6E-06	(µg/m^3)$^{-1}$	2.43E-07	1.30E-03	mg/m^3	NA	NA	NA
				1,2,3-Trichlorobenzene	8.50E+00	µg/L	4.08E-02	µg/m^3	NA	NA	NA	3.49E-04	mg/m^3	NA	NA	NA
				1,2-Dichloroethane	2.87E-01	µg/L	1.65E-03	µg/m^3	2.6E-05	(µg/m^3)$^{-1}$	4.30E-08	1.41E-05	mg/m^3	7.0E-03	mg/m^3	2.02E-03
				1,4-Dichlorobenzene	1.02E+01	µg/L	5.00E-02	µg/m^3	1.1E-05	(µg/m^3)$^{-1}$	5.50E-07	4.27E-04	mg/m^3	8.0E-01	mg/m^3	5.34E-04
				Benzene	8.15E-01	µg/L	4.49E-03	µg/m^3	7.8E-06	(µg/m^3)$^{-1}$	3.50E-08	3.84E-05	mg/m^3	3.0E-02	mg/m^3	1.28E-03
				Bromodichloromethane	4.69E-01	µg/L	2.65E-03	µg/m^3	3.7E-05	(µg/m^3)$^{-1}$	9.81E-08	2.26E-05	mg/m^3	NA	NA	NA
				Chlorobenzene	3.15E+01	µg/L	1.64E-01	µg/m^3	NA	NA	NA	1.40E-03	mg/m^3	5.0E-02	mg/m^3	2.81E-02
				Chloroform	3.33E+00	µg/L	1.90E-02	µg/m^3	2.3E-05	(µg/m^3)$^{-1}$	4.38E-07	1.63E-04	mg/m^3	3.0E-01	mg/m^3	5.42E-04
				cis-1,2-Dichloroethene	5.31E+01	µg/L	3.11E-01	µg/m^3	NA	NA	NA	2.66E-03	mg/m^3	NA	NA	NA
				Trichloroethene	1.84E+02	µg/L	See Table F-7.0.9	NA	4.1E-06	(µg/m^3)$^{-1}$	7.25E-05	8.62E-03	mg/m^3	2.0E-03	mg/m^3	4.31E+00
				Vinyl Chloride	1.97E+01	µg/L	6.79E+01	µg/m^3	4.4E-06	(µg/m^3)$^{-1}$	2.99E-04	1.03E-03	mg/m^3	1.0E-01	mg/m^3	1.03E-02
			Exp. Route Total								3.73E-04					4.35E+00
		Exposure Point Total									2.54E-03					3.25E+01

[1] Noncancer hazards presented for the child receptor (birth to <6 years); cancer risks presented for the lifetime receptor.

RfD = reference dose
NA = not applicable

mg/kg = milligram per kilogram
mg/kg-day = milligram per kilogram per day

µg/m^3 = microgram per cubic meter
mg/m^3 = milligram per cubic meter

TABLE F-7.2
CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS
CENTRAL TENDENCY EXPOSURE
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

Scenario Timeframe:	Future
Receptor Population:	Resident
Receptor Age:	Adult/Lifetime[1]

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	Exposure Point Concentration		Cancer Risk Calculation					Adult Noncancer Hazard Calculation				
							Intake/ Exposure Concentration		Slope Factor/Unit Risk		Cancer	Intake/ Exposure Concentration		RfD/RfC		Hazard
					Value	Unit	Value	Unit	Value	Unit	Risk	Value	Unit	Value	Unit	Quotient
Groundwater	Groundwater	Tap Water	Ingestion	**Volatile Organic Compounds**												
				1,1,2,2-Tetrachloroethane	2.40E-01	µg/L	6.36E-07	mg/kg-day	2.0E-01	$(mg/kg-day)^{-1}$	1.27E-07	2.88E-06	mg/kg-day	2.0E-02	mg/kg-day	1.44E-04
				1,1-Dichloroethane	2.71E+01	µg/L	7.18E-05	mg/kg-day	5.7E-03	$(mg/kg-day)^{-1}$	4.09E-07	3.25E-04	mg/kg-day	2.0E-01	mg/kg-day	1.62E-03
				1,2,3-Trichlorobenzene	8.50E+00	µg/L	2.25E-05	mg/kg-day	NA	NA	NA	1.02E-04	mg/kg-day	8.0E-04	mg/kg-day	1.27E-01
				1,2-Dichloroethane	2.87E-01	µg/L	7.61E-07	mg/kg-day	9.1E-02	$(mg/kg-day)^{-1}$	6.92E-08	3.44E-06	mg/kg-day	6.0E-03	mg/kg-day	5.73E-04
				1,4-Dichlorobenzene	1.02E+01	µg/L	2.70E-05	mg/kg-day	5.4E-03	$(mg/kg-day)^{-1}$	1.46E-07	1.22E-04	mg/kg-day	7.0E-02	mg/kg-day	1.74E-03
				Benzene	8.15E-01	µg/L	2.16E-06	mg/kg-day	5.5E-02	$(mg/kg-day)^{-1}$	1.19E-07	9.77E-06	mg/kg-day	4.0E-03	mg/kg-day	2.44E-03
				Bromodichloromethane	4.69E-01	µg/L	1.24E-06	mg/kg-day	6.2E-02	$(mg/kg-day)^{-1}$	7.71E-08	5.62E-06	mg/kg-day	2.0E-02	mg/kg-day	2.81E-04
				Chlorobenzene	3.15E+01	µg/L	8.36E-05	mg/kg-day	NA	NA	NA	3.78E-04	mg/kg-day	2.0E-02	mg/kg-day	1.89E-02
				Chloroform	3.33E+00	µg/L	8.82E-06	mg/kg-day	3.1E-02	$(mg/kg-day)^{-1}$	2.73E-07	3.99E-05	mg/kg-day	1.0E-02	mg/kg-day	3.99E-03
				cis-1,2-Dichloroethene	5.31E+01	µg/L	1.41E-04	mg/kg-day	NA	NA	NA	6.36E-04	mg/kg-day	2.0E-03	mg/kg-day	3.18E-01
				Trichloroethene	1.84E+02	µg/L	See Table B-7.0.9	NA	4.6E-02	$(mg/kg-day)^{-1}$	3.83E-05	2.21E-03	mg/kg-day	5.0E-04	mg/kg-day	4.42E+00
				Vinyl Chloride	1.97E+01	µg/L	5.66E-04	mg/kg-day	7.2E-01	$(mg/kg-day)^{-1}$	4.07E-04	2.37E-04	mg/kg-day	3.0E-03	mg/kg-day	7.89E-02
				Semi-volatile Organic Compounds												
				1,4-Dioxane	2.16E+01	µg/L	5.71E-05	mg/kg-day	1.0E-01	$(mg/kg-day)^{-1}$	5.71E-06	2.58E-04	mg/kg-day	3.0E-02	mg/kg-day	8.61E-03
				2,3,4,6-Tetrachlorophenol	1.10E+02	µg/L	2.92E-04	mg/kg-day	NA	NA	NA	1.32E-03	mg/kg-day	3.0E-02	mg/kg-day	4.39E-02
				Benzo(a)anthracene	3.50E-02	µg/L	4.53E-07	mg/kg-day	7.3E-01	$(mg/kg-day)^{-1}$	3.31E-07	4.20E-07	mg/kg-day	NA	NA	NA
				Benzo(b)fluoranthene	1.50E-01	µg/L	1.94E-06	mg/kg-day	7.3E-01	$(mg/kg-day)^{-1}$	1.42E-06	1.80E-06	mg/kg-day	NA	NA	NA
				Bis(2-Ethylhexyl)Phthalate	6.05E+00	µg/L	1.60E-05	mg/kg-day	1.4E-02	$(mg/kg-day)^{-1}$	2.24E-07	7.25E-05	mg/kg-day	2.0E-02	mg/kg-day	3.62E-03
				Naphthalene	1.28E-01	µg/L	3.39E-07	mg/kg-day	NA	NA	NA	1.53E-06	mg/kg-day	2.0E-02	mg/kg-day	7.67E-05
				Inorganics												
				Antimony	5.20E+00	µg/L	1.38E-05	mg/kg-day	NA	NA	NA	6.23E-05	mg/kg-day	4.0E-04	mg/kg-day	1.56E-01
				Chromium	6.22E+02	µg/L	1.65E-03	mg/kg-day	5.0E-01	$(mg/kg-day)^{-1}$	8.24E-04	7.46E-03	mg/kg-day	3.0E-03	mg/kg-day	2.49E+00
				Cobalt	1.42E+01	µg/L	3.75E-05	mg/kg-day	NA	NA	NA	1.70E-04	mg/kg-day	3.0E-04	mg/kg-day	5.65E-01
				Iron	2.13E+04	µg/L	5.65E-02	mg/kg-day	NA	NA	NA	2.55E-01	mg/kg-day	7.0E-01	mg/kg-day	3.65E-01
				Lead	1.02E+01	µg/L	2.69E-05	mg/kg-day	NA	NA	NA	1.22E-04	mg/kg-day	NA	NA	NA
				Manganese	3.90E+03	µg/L	1.03E-02	mg/kg-day	NA	NA	NA	4.68E-02	mg/kg-day	1.4E-01	mg/kg-day	3.34E-01
				Nickel	1.26E+03	µg/L	3.34E-03	mg/kg-day	NA	NA	NA	1.51E-02	mg/kg-day	2.0E-02	mg/kg-day	7.55E-01
				Thallium	6.30E-02	µg/L	1.67E-07	mg/kg-day	NA	NA	NA	7.55E-07	mg/kg-day	1.0E-05	mg/kg-day	7.55E-02
			Exp. Route Total								1.28E-03					9.69E+00

TABLE F-7.2
CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS
CENTRAL TENDENCY EXPOSURE
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

Scenario Timeframe:	Future
Receptor Population:	Resident
Receptor Age:	Adult/Lifetime[1]

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	Exposure Point Concentration		Cancer Risk Calculation					Adult Noncancer Hazard Calculation				
							Intake/ Exposure Concentration		Slope Factor/Unit Risk		Cancer	Intake/ Exposure Concentration		RfD/RfC		Hazard
					Value	Unit	Value	Unit	Value	Unit	Risk	Value	Unit	Value	Unit	Quotient
Groundwater	Groundwater	Groundwater	Dermal	**Volatile Organic Compounds**												
			Contact	1,1,2,2-Tetrachloroethane	2.40E-01	µg/L	1.65E-07	mg/kg-day	2.0E-01	$(mg/kg\text{-}day)^{-1}$	3.30E-08	9.06E-07	mg/kg-day	2.0E-02	mg/kg-day	4.53E-05
				1,1-Dichloroethane	2.71E+01	µg/L	1.16E-05	mg/kg-day	5.7E-03	$(mg/kg\text{-}day)^{-1}$	6.60E-08	6.34E-05	mg/kg-day	2.0E-01	mg/kg-day	3.17E-04
				1,2,3-Trichlorobenzene	8.50E+00	µg/L	NA	NA	NA	NA	NA	NA	NA	8.0E-04	mg/kg-day	NA
				1,2-Dichloroethane	2.87E-01	µg/L	7.68E-08	mg/kg-day	9.1E-02	$(mg/kg\text{-}day)^{-1}$	6.99E-09	4.21E-07	mg/kg-day	6.0E-03	mg/kg-day	7.02E-05
				1,4-Dichlorobenzene	1.02E+01	µg/L	3.73E-05	mg/kg-day	5.4E-03	$(mg/kg\text{-}day)^{-1}$	2.01E-07	2.04E-04	mg/kg-day	7.0E-02	mg/kg-day	2.92E-03
				Benzene	8.15E-01	µg/L	6.81E-07	mg/kg-day	5.5E-02	$(mg/kg\text{-}day)^{-1}$	3.74E-08	3.73E-06	mg/kg-day	4.0E-03	mg/kg-day	9.33E-04
				Bromodichloromethane	4.69E-01	µg/L	2.09E-07	mg/kg-day	6.2E-02	$(mg/kg\text{-}day)^{-1}$	1.30E-08	1.15E-06	mg/kg-day	2.0E-02	mg/kg-day	5.74E-05
				Chlorobenzene	3.15E+01	µg/L	6.19E-05	mg/kg-day	NA	NA	NA	3.40E-04	mg/kg-day	2.0E-02	mg/kg-day	1.70E-02
				Chloroform	3.33E+00	µg/L	1.65E-06	mg/kg-day	3.1E-02	$(mg/kg\text{-}day)^{-1}$	5.13E-08	9.07E-06	mg/kg-day	1.0E-02	mg/kg-day	9.07E-04
				cis-1,2-Dichloroethene	5.31E+01	µg/L	NA	NA	NA	NA	NA	NA	NA	2.0E-03	mg/kg-day	NA
				Trichloroethene	1.84E+02	µg/L	See Table B-7.0.9	NA	4.6E-02	$(mg/kg\text{-}day)^{-1}$	1.00E-05	9.55E-04	mg/kg-day	5.0E-04	mg/kg-day	1.91E+00
				Vinyl Chloride	1.97E+01	µg/L	5.99E-05	mg/kg-day	7.2E-01	$(mg/kg\text{-}day)^{-1}$	4.31E-05	3.19E-05	mg/kg-day	3.0E-03	mg/kg-day	1.06E-02
				Semi-volatile Organic Compounds												
				1,4-Dioxane	2.16E+01	µg/L	4.22E-07	mg/kg-day	1.0E-01	$(mg/kg\text{-}day)^{-1}$	4.22E-08	2.32E-06	mg/kg-day	3.0E-02	mg/kg-day	7.72E-05
				2,3,4,6-Tetrachlorophenol	1.10E+02	µg/L	NA	NA	NA	NA	NA	NA	NA	3.0E-02	mg/kg-day	NA
				Benzo(a)anthracene	3.50E-02	µg/L	1.16E-05	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	8.47E-06	1.33E-05	mg/kg-day	NA	NA	NA
				Benzo(b)fluoranthene	1.50E-01	µg/L	8.65E-05	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	6.31E-05	9.91E-05	mg/kg-day	NA	NA	NA
				Bis(2-Ethylhexyl)Phthalate	6.05E+00	µg/L	5.10E-05	mg/kg-day	1.4E-02	$(mg/kg\text{-}day)^{-1}$	7.14E-07	2.80E-04	mg/kg-day	2.0E-02	mg/kg-day	1.40E-02
				Naphthalene	1.28E-01	µg/L	4.66E-07	mg/kg-day	NA	NA	NA	2.55E-06	mg/kg-day	2.0E-02	mg/kg-day	1.28E-04
				Inorganics												
				Antimony	5.20E+00	µg/L	1.59E-07	mg/kg-day	NA	NA	NA	8.74E-07	mg/kg-day	6.0E-05	mg/kg-day	1.46E-02
				Chromium	6.22E+02	µg/L	3.81E-05	mg/kg-day	2.0E+01	$(mg/kg\text{-}day)^{-1}$	7.62E-04	2.09E-04	mg/kg-day	7.5E-05	mg/kg-day	2.79E+00
				Cobalt	1.42E+01	µg/L	1.73E-07	mg/kg-day	NA	NA	NA	9.51E-07	mg/kg-day	3.0E-04	mg/kg-day	3.17E-03
				Iron	2.13E+04	µg/L	6.53E-04	mg/kg-day	NA	NA	NA	3.58E-03	mg/kg-day	7.0E-01	mg/kg-day	5.11E-03
				Lead	1.02E+01	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	3.90E+03	µg/L	1.20E-04	mg/kg-day	NA	NA	NA	6.56E-04	mg/kg-day	1.4E-01	mg/kg-day	4.69E-03
				Nickel	1.26E+03	µg/L	7.72E-06	mg/kg-day	NA	NA	NA	4.23E-05	mg/kg-day	8.0E-04	mg/kg-day	5.29E-02
				Thallium	6.30E-02	µg/L	1.93E-09	mg/kg-day	NA	NA	NA	1.06E-08	mg/kg-day	1.0E-05	mg/kg-day	1.06E-03
			Exp. Route Total								8.88E-04					4.82E+00
Groundwater	Groundwater	Groundwater	Inhalation	**Volatile Organic Compounds**												
				1,1,2,2-Tetrachloroethane	2.40E-01	µg/L	1.23E-03	$µg/m^3$	5.8E-05	$(µg/m^3)^{-1}$	7.16E-08	7.71E-06	mg/m^3	NA	NA	NA
				1,1-Dichloroethane	2.71E+01	µg/L	1.52E-01	$µg/m^3$	1.6E-06	$(µg/m^3)^{-1}$	2.43E-07	9.50E-04	mg/m^3	NA	NA	NA
				1,2,3-Trichlorobenzene	8.50E+00	µg/L	4.08E-02	$µg/m^3$	NA	NA	NA	2.55E-04	mg/m^3	NA	NA	NA
				1,2-Dichloroethane	2.87E-01	µg/L	1.65E-03	$µg/m^3$	2.6E-05	$(µg/m^3)^{-1}$	4.30E-08	1.03E-05	mg/m^3	7.0E-03	mg/m^3	1.47E-03
				1,4-Dichlorobenzene	1.02E+01	µg/L	5.00E-02	$µg/m^3$	1.1E-05	$(µg/m^3)^{-1}$	5.50E-07	3.12E-04	mg/m^3	8.0E-01	mg/m^3	3.90E-04
				Benzene	8.15E-01	µg/L	4.49E-03	$µg/m^3$	7.8E-06	$(µg/m^3)^{-1}$	3.50E-08	2.80E-05	mg/m^3	3.0E-02	mg/m^3	9.35E-04
				Bromodichloromethane	4.69E-01	µg/L	2.65E-03	$µg/m^3$	3.7E-05	$(µg/m^3)^{-1}$	9.81E-08	1.66E-05	mg/m^3	NA	NA	NA
				Chlorobenzene	3.15E+01	µg/L	1.64E-01	$µg/m^3$	NA	NA	NA	1.03E-03	mg/m^3	5.0E-02	mg/m^3	2.05E-02
				Chloroform	3.33E+00	µg/L	1.90E-02	$µg/m^3$	2.3E-05	$(µg/m^3)^{-1}$	4.38E-07	1.19E-04	mg/m^3	3.0E-01	mg/m^3	3.96E-04
				cis-1,2-Dichloroethene	5.31E+01	µg/L	3.11E-01	$µg/m^3$	NA	NA	NA	1.94E-03	mg/m^3	NA	NA	NA
				Trichloroethene	1.84E+02	µg/L	See Table B-7.0.9	NA	4.1E-06	$(µg/m^3)^{-1}$	7.25E-05	6.30E-03	mg/m^3	2.0E-03	mg/m^3	3.15E+00
				Vinyl Chloride	1.97E+01	µg/L	6.79E+01	$µg/m^3$	4.4E-06	$(µg/m^3)^{-1}$	2.99E-04	7.53E-04	mg/m^3	1.0E-01	mg/m^3	7.53E-03
			Exp. Route Total								3.73E-04					3.18E+00
		Exposure Point Total									2.54E-03					1.77E+01

[1] Noncancer hazards presented for the adult receptor; cancer risks presented for the lifetime receptor.

RfD = reference dose
NA = not applicable

mg/kg = milligram per kilogram
mg/kg-day = milligram per kilogram per day

$µg/m^3$ = microgram per cubic meter
mg/m^3 = milligram per cubic meter

TABLE F-9.1
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
CENTRAL TENDENCY EXPOSURE
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Resident
Receptor Age:	Child/Lifetime[1]

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Groundwater	Groundwater	Tap Water	**Volatile Organic Compounds**									
			1,1,2,2-Tetrachloroethane	1E-07	3E-08	7E-08	2E-07	Liver	3E-04	7E-05	NA	4E-04
			1,1-Dichloroethane	4E-07	7E-08	2E-07	7E-07	Kidney	3E-03	5E-04	NA	4E-03
			1,2,3-Trichlorobenzene	NA	NA	NA	NA	Body Weight/Liver/Thyroid	3E-01	NA	NA	3E-01
			1,2-Dichloroethane	7E-08	7E-09	4E-08	1E-07	Liver/Kidney	1E-03	1E-04	2E-03	3E-03
			1,4-Dichlorobenzene	1E-07	2E-07	6E-07	9E-07	Liver	4E-03	5E-03	5E-04	9E-03
			Benzene	1E-07	4E-08	4E-08	2E-07	Blood	5E-03	2E-03	1E-03	8E-03
			Bromodichloromethane	8E-08	1E-08	1E-07	2E-07	Liver	6E-04	9E-05	NA	7E-04
			Chlorobenzene	NA	NA	NA	NA	Liver/Kidney	4E-02	3E-02	3E-02	1E-01
			Chloroform	3E-07	5E-08	4E-07	8E-07	Liver/Alimentary System/ Kidney/Developmental	8E-03	1E-03	5E-04	1E-02
			cis-1,2-Dichloroethene	NA	NA	NA	NA	Kidney	7E-01	NA	NA	7E-01
			Trichloroethene	4E-05	1E-05	7E-05	1E-04	Heart/ Immune System/ Developmental/Kidney/Liver	9E+00	3E+00	4E+00	2E+01
			Vinyl Chloride	4E-04	4E-05	3E-04	7E-04	Liver	2E-01	2E-02	1E-02	2E-01
			Semi-volatile Organic Compounds									
			1,4-Dioxane	6E-06	4E-08	NA	6E-06	Liver/Kidney/CNS/Respiratory System	2E-02	1E-04	NA	2E-02
			2,3,4,6-Tetrachlorophenol	NA	NA	NA	NA	Liver	9E-02	NA	NA	9E-02
			Benzo(a)anthracene	3E-07	8E-06	NA	9E-06	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	1E-06	6E-05	NA	6E-05	NA	NA	NA	NA	NA
			Bis(2-Ethylhexyl)Phthalate	2E-07	7E-07	NA	9E-07	Liver	8E-03	2E-02	NA	3E-02
			Naphthalene	NA	NA	NA	NA	Body Weight/CNS/Respiratory System	2E-04	2E-04	NA	4E-04
			Inorganics									
			Antimony	NA	NA	NA	NA	Longevity/Blood/Lung	3E-01	2E-02	NA	3E-01
			Chromium	8E-04	8E-04	NA	2E-03	Lung	5E+00	5E+00	NA	1E+01
			Cobalt	NA	NA	NA	NA	Thyroid/Respiratory System/ Lung	1E+00	5E-03	NA	1E+00
			Iron	NA	NA	NA	NA	GI Tract	8E-01	8E-03	NA	8E-01
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	CNS	7E-01	8E-03	NA	7E-01
			Nickel	NA	NA	NA	NA	Body and Organ Weight/Respiratory System	2E+00	9E-02	NA	2E+00
			Thallium	NA	NA	NA	NA	Skin/Hair	2E-01	2E-03	NA	2E-01
			Chemical Total	1E-03	9E-04	4E-04	3E-03	Chemical Total	2E+01	8E+00	4E+00	3E+01
		Exposure Point Total					3E-03					3E+01
	Exposure Medium Total						3E-03					3E+01
Medium Total							3E-03					3E+01
Receptor Total							3E-03					3E+01

Total Excess Cancer Risk Across All Media: 3E-03

Total Hazard Index (HI) Across All Media: 33

TABLE F-9.1
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
CENTRAL TENDENCY EXPOSURE
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Resident
Receptor Age:	Child/Lifetime[1]

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total

[1] Noncancer hazards presented for the child receptor (birth to <6 years); cancer risks presented for the lifetime receptor.

Alimentary System HI Across All Media =	0.01
Blood HI Across All Media =	0.4
Body and Organ Weight HI Across All Media =	2
Body weight HI Across All Media =	0.3
CNS HI Across All Media =	0.7
Development HI Across All Media =	17
GI Tract HI Across All Media =	0.8
Hair HI Across All Media =	0.2
Heart HI Across All Media =	17
Immune system HI Across All Media =	17
Kidney HI Across All Media =	17
Liver HI Across All Media =	17
Longevity HI Across All Media =	0.3
Lung HI Across All Media =	11
Respiratory System HI Across All Media =	3
Skin HI Across All Media =	0.2
Thyroid HI Across All Media =	1

NA = not applicable CNS = central nervous system GI = gastrointestinal

TABLE F-9.2
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
CENTRAL TENDENCY EXPOSURE
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

Scenario Timeframe:	Future
Receptor Population:	Resident
Receptor Age:	Adult/Lifetime[1]

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Adult Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Groundwater	Groundwater	Tap Water	**Volatile Organic Compounds**									
			1,1,2,2-Tetrachloroethane	1E-07	3E-08	7E-08	2E-07	Liver	1E-04	5E-05	NA	2E-04
			1,1-Dichloroethane	4E-07	7E-08	2E-07	7E-07	Kidney	2E-03	3E-04	NA	2E-03
			1,2,3-Trichlorobenzene	NA	NA	NA	NA	Body Weight/Liver/Thyroid	1E-01	NA	NA	1E-01
			1,2-Dichloroethane	7E-08	7E-09	4E-08	1E-07	Liver/Kidney	6E-04	7E-05	1E-03	2E-03
			1,4-Dichlorobenzene	1E-07	2E-07	6E-07	9E-07	Liver	2E-03	3E-03	4E-04	5E-03
			Benzene	1E-07	4E-08	4E-08	2E-07	Blood	2E-03	9E-04	9E-04	4E-03
			Bromodichloromethane	8E-08	1E-08	1E-07	2E-07	Liver	3E-04	6E-05	NA	3E-04
			Chlorobenzene	NA	NA	NA	NA	Liver/Kidney	2E-02	2E-02	2E-02	6E-02
			Chloroform	3E-07	5E-08	4E-07	8E-07	Liver/Alimentary System/ Kidney/Developmental	4E-03	9E-04	4E-04	5E-03
			cis-1,2-Dichloroethene	NA	NA	NA	NA	Kidney	3E-01	NA	NA	3E-01
			Trichloroethene	4E-05	1E-05	7E-05	1E-04	Heart/ Immune System/ Developmental/Kidney/Liver	4E+00	2E+00	3E+00	9E+00
			Vinyl Chloride	4E-04	4E-05	3E-04	7E-04	Liver	8E-02	1E-02	8E-03	1E-01
			Semi-volatile Organic Compounds									
			1,4-Dioxane	6E-06	4E-08	NA	6E-06	Liver/Kidney/CNS/Respiratory System	9E-03	8E-05	NA	9E-03
			2,3,4,6-Tetrachlorophenol	NA	NA	NA	NA	Liver	4E-02	NA	NA	4E-02
			Benzo(a)anthracene	3E-07	8E-06	NA	9E-06	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	1E-06	6E-05	NA	6E-05	NA	NA	NA	NA	NA
			Bis(2-Ethylhexyl)Phthalate	2E-07	7E-07	NA	9E-07	Liver	4E-03	1E-02	NA	2E-02
			Naphthalene	NA	NA	NA	NA	Body Weight/CNS/Respiratory System	8E-05	1E-04	NA	2E-04
			Inorganics									
			Antimony	NA	NA	NA	NA	Longevity/Blood/Lung	2E-01	1E-02	NA	2E-01
			Chromium	8E-04	8E-04	NA	2E-03	Lung	2E+00	3E+00	NA	5E+00
			Cobalt	NA	NA	NA	NA	Thyroid/Respiratory System/ Lung	6E-01	3E-03	NA	6E-01
			Iron	NA	NA	NA	NA	GI Tract	4E-01	5E-03	NA	4E-01
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	CNS	3E-01	5E-03	NA	3E-01
			Nickel	NA	NA	NA	NA	Body and Organ Weight/Respiratory System	8E-01	5E-02	NA	8E-01
			Thallium	NA	NA	NA	NA	Skin/Hair	8E-02	1E-03	NA	8E-02
			Chemical Total	1E-03	9E-04	4E-04	3E-03	Chemical Total	1E+01	5E+00	3E+00	2E+01
		Exposure Point Total					3E-03					2E+01
	Exposure Medium Total						3E-03					2E+01
Medium Total							3E-03					2E+01
Receptor Total							3E-03					2E+01

Total Excess Cancer Risk Across All Media: 3E-03

Total Hazard Index (HI) Across All Media: 18

TABLE F-9.2
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
CENTRAL TENDENCY EXPOSURE
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

Scenario Timeframe:	Future
Receptor Population:	Resident
Receptor Age:	Adult/Lifetime[(1)]

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Adult Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total

[(1)] Noncancer hazards presented for the adult receptor; cancer risks presented for the lifetime receptor

Alimentary System HI Across All Media =	<0.01
Blood HI Across All Media =	0.2
Body and Organ Weight HI Across All Media =	0.8
Body weight HI Across All Media =	0.1
CNS HI Across All Media =	0.3
Development HI Across All Media =	9
GI Tract HI Across All Media =	0.4
Hair HI Across All Media =	0.08
Heart HI Across All Media =	9
Immune system HI Across All Media =	9
Kidney HI Across All Media =	10
Liver HI Across All Media =	10
Longevity HI Across All Media =	0.2
Lung HI Across All Media =	6
Respiratory System HI Across All Media =	1
Skin HI Across All Media =	0.08
Thyroid HI Across All Media =	0.7

NA = not applicable CNS = central nervous system GI = gastrointestinal

TABLE F-10.1
RISK ASSESSMENT SUMMARY
CENTRAL TENDENCY EXPOSURE
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Resident
Receptor Age:	Child/Lifetime[(1)]

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Child Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Groundwater	Groundwater	Tap Water	**Volatile Organic Compounds**									
			Trichloroethene	4E-05	1E-05	7E-05	1E-04	Heart/ Immune System/ Developmental/Kidney/Liver	9E+00	3E+00	4E+00	2E+01
			Vinyl Chloride	4E-04	4E-05	3E-04	7E-04	Liver	2E-01	2E-02	1E-02	2E-01
			Semi-volatile Organic Compounds									
			1,4-Dioxane	6E-06	4E-08	NA	6E-06	Liver/Kidney/CNS/Respiratory System	2E-02	1E-04	NA	2E-02
			Benzo(a)anthracene	3E-07	8E-06	NA	9E-06	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	1E-06	6E-05	NA	6E-05	NA	NA	NA	NA	NA
			Inorganics									
			Chromium	8E-04	8E-04	NA	2E-03	Lung	5E+00	5E+00	NA	1E+01
			Cobalt	NA	NA	NA	NA	Thyroid/Respiratory System/ Lung	1E+00	5E-03	NA	1E+00
			Nickel	NA	NA	NA	NA	Body and Organ Weight/Respiratory System	2E+00	9E-02	NA	2E+00
			Chemical Total	1E-03	9E-04	4E-04	3E-03	Chemical Total	2E+01	8E+00	4E+00	3E+01
		Exposure Point Total					3E-03					3E+01
	Exposure Medium Total						3E-03					3E+01
Medium Total							3E-03					3E+01
Receptor Total							3E-03					3E+01

Total Excess Cancer Risk Across All Media	3E-03
Total Hazard Index (HI) Across All Media	33

[(1)] Noncancer hazards presented for the child receptor (birth to <6 years); cancer risks presented for the lifetime receptor.

Body and Organ Weight HI Across All Media =	2
Development HI Across All Media =	17
Heart HI Across All Media =	17
Immune system HI Across All Media =	17
Kidney HI Across All Media =	17
Liver HI Across All Media =	17
Lung HI Across All Media =	11
Respiratory System HI Across All Media =	3
Thyroid HI Across All Media =	1

NA = not applicable CNS = central nervous system GI = gastrointestinal

Note:
Only chemicals above EPA's threshold values are listed in this table

TABLE F-10.2
RISK ASSESSMENT SUMMARY
CENTRAL TENDENCY EXPOSURE
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

Scenario Timeframe:	Future
Receptor Population:	Resident
Receptor Age:	Adult/Lifetime[1]

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Adult Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Groundwater	Groundwater	Tap Water	**Volatile Organic Compounds**									
			Trichloroethene	4E-05	1E-05	7E-05	1E-04	Heart/ Immune System/ Developmental/Kidney/Liver	4E+00	2E+00	3E+00	9E+00
			Vinyl Chloride	4E-04	4E-05	3E-04	7E-04	Liver	8E-02	1E-02	8E-03	1E-01
			Semi-volatile Organic Compounds									
			1,4-Dioxane	6E-06	4E-08	NA	6E-06	Liver/Kidney/CNS/Respiratory System	9E-03	8E-05	NA	9E-03
			Benzo(a)anthracene	3E-07	8E-06	NA	9E-06	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	1E-06	6E-05	NA	6E-05	NA	NA	NA	NA	NA
			Inorganics									
			Chromium	8E-04	8E-04	NA	2E-03	Lung	2E+00	3E+00	NA	5E+00
			Chemical Total	1E-03	9E-04	4E-04	3E-03	Chemical Total	1E+01	5E+00	3E+00	2E+01
		Exposure Point Total					3E-03					2E+01
	Exposure Medium Total						3E-03					2E+01
Medium Total							3E-03					2E+01
Receptor Total							3E-03					2E+01

Total Excess Cancer Risk Across All Media	3E-03
Total Hazard Index (HI) Across All Media	2E+01

Development HI Across All Media =	9
Heart HI Across All Media =	9
Immune system HI Across All Media =	9
Kidney HI Across All Media =	10
Liver HI Across All Media =	10
Lung HI Across All Media =	6
Respiratory System HI Across All Media =	1

NA = not applicable CNS = central nervous system GI = gastrointestinal

Note:

Only chemicals above EPA's threshold values are listed in this table

Appendix G

Appendix G
Outlier Testing

Appendix G Contents

Mansfield Trail Dump Site, OU1

Byram Township, New Jersey

Table G-1

ProUCL Output from Outlier Testing - High Chromium and Nickel

Mansfiedl Trail Dump Site, OU1

Byram Township, New Jersey

Run 1 - High Chromium and Nickel

Outlier Tests for Selected Uncensored Variables

User Selected Options

Date/Time of Computation	ProUCL 5.11/10/2017 9:42:23 AM
From File	Cr Ni Outlier Input 1_a.xls
Full Precision	OFF

Dixon's Outlier Test for Chromium

Number of Observations = 10

10% critical value: 0.409

5% critical value: 0.477

1% critical value: 0.597

1. Observation Value 622 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.940

For 10% significance level, 622 is an outlier.

For 5% significance level, 622 is an outlier.

For 1% significance level, 622 is an outlier.

2. Observation Value 0.48 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.011

For 10% significance level, 0.48 is not an outlier.

For 5% significance level, 0.48 is not an outlier.

For 1% significance level, 0.48 is not an outlier.

Dixon's Outlier Test for Nickel

Number of Observations = 10

10% critical value: 0.409

5% critical value: 0.477

1% critical value: 0.597

1. Observation Value 1260 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.973

For 10% significance level, 1260 is an outlier.

For 5% significance level, 1260 is an outlier.

For 1% significance level, 1260 is an outlier.

Table G-1

ProUCL Output from Outlier Testing - High Chromium and Nickel

Mansfiedl Trail Dump Site, OU1

Byram Township, New Jersey

2. Observation Value 1 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.003

For 10% significance level, 1 is not an outlier.

For 5% significance level, 1 is not an outlier.

For 1% significance level, 1 is not an outlier.

Table G-2

ProUCL Statistics - Run 2 - Low Chromium and Nickel

Mansfiedl Trail Dump Site, OU1

Byram Township, New Jersey

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.11/10/2017 11:51:29 AM
From File	Cr Ni Outlier Testing Run 2_b.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chromium

General Statistics

Total Number of Observations	10	Number of Distinct Observations	10
		Number of Missing Observations	0
Minimum	0.48	Mean	8.473
Maximum	38.2	Median	1.3
SD	15.23	Std. Error of Mean	4.818
Coefficient of Variation	1.798	Skewness	1.776

Normal GOF Test

Shapiro Wilk Test Statistic	0.547	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.842	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.452	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.262	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	17.3	95% Adjusted-CLT UCL (Chen-1995)	19.29
		95% Modified-t UCL (Johnson-1978)	17.76

Gamma GOF Test

A-D Test Statistic	1.685	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.78	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.38	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.281	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.484	k star (bias corrected MLE)	0.406
Theta hat (MLE)	17.49	Theta star (bias corrected MLE)	20.88
nu hat (MLE)	9.689	nu star (bias corrected)	8.115
MLE Mean (bias corrected)	8.473	MLE Sd (bias corrected)	13.3
		Approximate Chi Square Value (0.05)	2.802
Adjusted Level of Significance	0.0267	Adjusted Chi Square Value	2.289

Table G-2

ProUCL Statistics - Run 2 - Low Chromium and Nickel

Mansfiedl Trail Dump Site, OU1

Byram Township, New Jersey

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	24.54	95% Adjusted Gamma UCL (use when n<50)	30.04

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.762	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.842	Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.275	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.262	Data Not Lognormal at 5% Significance Level	

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-0.734	Mean of logged Data	0.819
Maximum of Logged Data	3.643	SD of logged Data	1.54

Assuming Lognormal Distribution

95% H-UCL	67.64	90% Chebyshev (MVUE) UCL	15.4
95% Chebyshev (MVUE) UCL	19.63	97.5% Chebyshev (MVUE) UCL	25.5
99% Chebyshev (MVUE) UCL	37.03		

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	16.4	95% Jackknife UCL	17.3
95% Standard Bootstrap UCL	16.06	95% Bootstrap-t UCL	201.8
95% Hall's Bootstrap UCL	134.5	95% Percentile Bootstrap UCL	15.83
95% BCA Bootstrap UCL	19.31		
90% Chebyshev(Mean, Sd) UCL	22.93	95% Chebyshev(Mean, Sd) UCL	29.47
97.5% Chebyshev(Mean, Sd) UCL	38.56	99% Chebyshev(Mean, Sd) UCL	56.41

Suggested UCL to Use

99% Chebyshev (Mean, Sd) UCL	56.41

Recommended UCL exceeds the maximum observation

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Nickel

General Statistics

Total Number of Observations	10	Number of Distinct Observations	9
Number of Detects	9	Number of Non-Detects	1
Number of Distinct Detects	8	Number of Distinct Non-Detects	1
Minimum Detect	1.1	Minimum Non-Detect	1
Maximum Detect	34.8	Maximum Non-Detect	1
Variance Detects	180.9	Percent Non-Detects	10%
Mean Detects	9	SD Detects	13.45
Median Detects	2.4	CV Detects	1.494
Skewness Detects	1.591	Kurtosis Detects	0.831
Mean of Logged Detects	1.253	SD of Logged Detects	1.383

Table G-2

ProUCL Statistics - Run 2 - Low Chromium and Nickel

Mansfiedl Trail Dump Site, OU1

Byram Township, New Jersey

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.639	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.354	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	8.2	KM Standard Error of Mean	4.114
KM SD	12.27	95% KM (BCA) UCL	14.43
95% KM (t) UCL	15.74	95% KM (Percentile Bootstrap) UCL	14.84
95% KM (z) UCL	14.97	95% KM Bootstrap t UCL	56.51
90% KM Chebyshev UCL	20.54	95% KM Chebyshev UCL	26.13
97.5% KM Chebyshev UCL	33.89	99% KM Chebyshev UCL	49.14

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.09	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.759	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.317	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.291	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.647	k star (bias corrected MLE)	0.506
Theta hat (MLE)	13.91	Theta star (bias corrected MLE)	17.8
nu hat (MLE)	11.65	nu star (bias corrected)	9.099
Mean (detects)	9		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	8.101
Maximum	34.8	Median	1.85
SD	12.99	CV	1.604
k hat (MLE)	0.453	k star (bias corrected MLE)	0.384
Theta hat (MLE)	17.89	Theta star (bias corrected MLE)	21.12
nu hat (MLE)	9.056	nu star (bias corrected)	7.672
Adjusted Level of Significance (β)	0.0267		
Approximate Chi Square Value (7.67, α)	2.547	Adjusted Chi Square Value (7.67, β)	2.064
95% Gamma Approximate UCL (use when n>=50)	24.41	95% Gamma Adjusted UCL (use when n<50)	30.12

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	8.2	SD (KM)	12.27
Variance (KM)	150.5	SE of Mean (KM)	4.114
k hat (KM)	0.447	k star (KM)	0.379
nu hat (KM)	8.937	nu star (KM)	7.59
theta hat (KM)	18.35	theta star (KM)	21.61
80% gamma percentile (KM)	13.15	90% gamma percentile (KM)	23.37
95% gamma percentile (KM)	34.69	99% gamma percentile (KM)	63.32

Table G-2

ProUCL Statistics - Run 2 - Low Chromium and Nickel

Mansfiedl Trail Dump Site, OU1

Byram Township, New Jersey

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (7.59, α)	2.5	Adjusted Chi Square Value (7.59, β)	2.022
95% Gamma Approximate KM-UCL (use when n>=50)	24.9	95% Gamma Adjusted KM-UCL (use when n<50)	30.78

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.802	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.829	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.252	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.274	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	8.114	Mean in Log Scale	0.93
SD in Original Scale	12.99	SD in Log Scale	1.656
95% t UCL (assumes normality of ROS data)	15.64	95% Percentile Bootstrap UCL	14.78
95% BCA Bootstrap UCL	17.09	95% Bootstrap t UCL	55.65
95% H-UCL (Log ROS)	124.6		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	1.128	KM Geo Mean	3.088
KM SD (logged)	1.293	95% Critical H Value (KM-Log)	3.735
KM Standard Error of Mean (logged)	0.434	95% H-UCL (KM -Log)	35.63
KM SD (logged)	1.293	95% Critical H Value (KM-Log)	3.735
KM Standard Error of Mean (logged)	0.434		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	8.15	Mean in Log Scale	1.058
SD in Original Scale	12.96	SD in Log Scale	1.442
95% t UCL (Assumes normality)	15.66	95% H-Stat UCL	57.72

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	26.13

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Appendix H

Appendix H
Select RAGS D Risk Calculations without Outliers

Appendix H Contents
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

[(1)] Noncancer hazards presented for the child receptor (birth to <6 years); cancer risks presented for the lifetime receptor.
[(2)] Noncancer hazards presented for the adult receptor; cancer risks presented for the lifetime receptor.

TABLE H-3.1
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

Scenario Timeframe:	Current/Future
Medium:	Groundwater
Exposure Medium:	Groundwater

Exposure Point	Chemical of Potential Concern	Unit	Mean Concentration [1]	Upper Confidence Limit [1]	Maximum Concentration (Qualifier)	Exposure Point Concentration [2]			
						Value	Unit	Statistic [3]	Rationale [4]
Groundwater	**Volatile Organic Compounds**								
	1,1,2,2-Tetrachloroethane	µg/L	NA	NA	0.24 J	0.24	µg/L	Max	<4 detected values
	1,1-Dichloroethane	µg/L	7.6	27.1	35	27.1	µg/L	UCL-G	95% Adjusted Gamma UCL
	1,2,3-Trichlorobenzene	µg/L	8.9	8.5	24 JN	8.5	µg/L	UCL-NP	95% KM (t) UCL
	1,2-Dichloroethane	µg/L	0.19	0.29	0.34 J	0.29	µg/L	UCL-NP	95% KM (t) UCL
	1,4-Dichlorobenzene	µg/L	3.7	10.2	13	10.2	µg/L	UCL-NP	95% KM Bootstrap t UCL
	Benzene	µg/L	0.66	0.82	1.6	0.82	µg/L	UCL-NP	95% KM (t) UCL
	Bromodichloromethane	µg/L	0.37	0.47	0.71	0.47	µg/L	UCL-NP	95% KM (t) UCL
	Chlorobenzene	µg/L	31.2	31.5	70	31.5	µg/L	UCL-NP	95% KM (t) UCL
	Chloroform	µg/L	2.7	3.3	7.4	3.3	µg/L	UCL-NP	95% KM (t) UCL
	cis-1,2-Dichloroethene	µg/L	34.3	53.1	90	53	µg/L	UCL-N	95% Student's-t UCL
	Trichloroethene	µg/L	60.6	184	270	184	µg/L	UCL-G	95% Adjusted Gamma UCL
	Vinyl Chloride	µg/L	15.5	19.7	50	19.7	µg/L	UCL-NP	95% KM (t) UCL
	Semi-volatile Organic Compounds								
	1,4-Dioxane	µg/L	6.3	21.6	26	21.55	µg/L	UCL-G	95% Gamma Adjusted KM-UCL
	2,3,4,6-Tetrachlorophenol	µg/L	NA	NA	110 JN	110	µg/L	Max	<4 detected values
	Benzo(a)anthracene	µg/L	NA	NA	0.035 J	0.035	µg/L	Max	<4 detected values
	Benzo(b)fluoranthene	µg/L	NA	NA	0.15 J	0.15	µg/L	Max	<4 detected values
	Bis(2-Ethylhexyl)Phthalate	µg/L	5.1	6.0	12	6.0	µg/L	UCL-NP	95% KM (t) UCL
	Naphthalene	µg/L	0.103	0.13	0.26	0.13	µg/L	UCL-NP	95% KM (t) UCL
	Inorganics								
	Antimony	µg/L	NA	NA	5.2	5.2	µg/L	Max	<4 detected values
	Chromium	µg/L	8.5	56	38.2	38.2	µg/L	Max	UCL > Max
	Cobalt	µg/L	5.8	14.2	19.5	14.2	µg/L	UCL-G	95% Gamma Adjusted KM-UCL
	Iron	µg/L	5675	21304	30100	21304	µg/L	UCL-G	95% Adjusted Gamma UCL
	Lead	µg/L	10.2	NA	22.8	10.2	µg/L	Mean	Arithmetic Mean
	Manganese	µg/L	1267	3904	4370	3904	µg/L	UCL-G	95% Adjusted Gamma UCL
	Nickel	µg/L	9	26.13	34.8	26.13	µg/L	Max	95% KM (Chebyshev) UCL
	Thallium	µg/L	NA	NA	0.063 J	0.063	µg/L	Max	<4 detected values

µg/L = microgram per liter
NA = not applicable
J = qualifier for estimated value
JN = qualifier for tentatively identified and estimated value

Notes:

[1] Mean and upper confidence limit (UCL) concentrations are calculated using ProUCL version 5.1.00 for chemicals with at least 5 samples in a dataset and 4 detected values.

[2] Exposure point concentration is lower of maximum concentration and UCL.

[3] Statistic:
UCL-N = upper confidence limit of mean of normal distribution
UCL-NP = upper confidence limit of mean of non-parametric distribution
UCL-G = upper confidence limit of mean of gamma distribution
Max = maximum detected concentration
Mean = arithmetic mean

[4] Rationale: UCL statistic was selected based on the "Suggested UCL to Use" in ProUCL version 5.1.00 output. See Appendix C.

TABLE H-7.1
CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Resident
Receptor Age:	Child/Lifetime[1]

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	Exposure Point Concentration		Cancer Risk Calculation					Noncancer Hazard Calculation				
							Intake/ Exposure Concentration		Slope Factor/Unit Risk		Cancer	Intake/ Exposure Concentration		RfD/RfC		Hazard
					Value	Unit	Value	Unit	Value	Unit	Risk	Value	Unit	Value	Unit	Quotient
Groundwater	Groundwater	Tap Water	Ingestion	**Volatile Organic Compounds**												
				1,1,2,2-Tetrachloroethane	2.40E-01	µg/L	3.08E-06	mg/kg-day	2.0E-01	$(mg/kg\text{-}day)^{-1}$	6.16E-07	1.20E-05	mg/kg-day	2.0E-02	mg/kg-day	5.98E-04
				1,1-Dichloroethane	2.71E+01	µg/L	3.48E-04	mg/kg-day	5.7E-03	$(mg/kg\text{-}day)^{-1}$	1.98E-06	1.35E-03	mg/kg-day	2.0E-01	mg/kg-day	6.75E-03
				1,2,3-Trichlorobenzene	8.50E+00	µg/L	1.09E-04	mg/kg-day	NA	NA	NA	4.24E-04	mg/kg-day	8.0E-04	mg/kg-day	5.30E-01
				1,2-Dichloroethane	2.87E-01	µg/L	3.68E-06	mg/kg-day	9.1E-02	$(mg/kg\text{-}day)^{-1}$	3.35E-07	1.43E-05	mg/kg-day	6.0E-03	mg/kg-day	2.39E-03
				1,4-Dichlorobenzene	1.02E+01	µg/L	1.31E-04	mg/kg-day	5.4E-03	$(mg/kg\text{-}day)^{-1}$	7.06E-07	5.08E-04	mg/kg-day	7.0E-02	mg/kg-day	7.25E-03
				Benzene	8.15E-01	µg/L	1.05E-05	mg/kg-day	5.5E-02	$(mg/kg\text{-}day)^{-1}$	5.75E-07	4.06E-05	mg/kg-day	4.0E-03	mg/kg-day	1.02E-02
				Bromodichloromethane	4.69E-01	µg/L	6.02E-06	mg/kg-day	6.2E-02	$(mg/kg\text{-}day)^{-1}$	3.73E-07	2.34E-05	mg/kg-day	2.0E-02	mg/kg-day	1.17E-03
				Chlorobenzene	3.15E+01	µg/L	4.05E-04	mg/kg-day	NA	NA	NA	1.57E-03	mg/kg-day	2.0E-02	mg/kg-day	7.86E-02
				Chloroform	3.33E+00	µg/L	4.27E-05	mg/kg-day	3.1E-02	$(mg/kg\text{-}day)^{-1}$	1.32E-06	1.66E-04	mg/kg-day	1.0E-02	mg/kg-day	1.66E-02
				cis-1,2-Dichloroethene	5.31E+01	µg/L	6.81E-04	mg/kg-day	NA	NA	NA	2.65E-03	mg/kg-day	2.0E-03	mg/kg-day	1.32E+00
				Trichloroethene	1.84E+02	µg/L	See Table B-7.0.9	NA	4.6E-02	NA	1.55E-04	9.18E-03	mg/kg-day	5.0E-04	mg/kg-day	1.84E+01
				Vinyl Chloride	1.97E+01	µg/L	1.28E-03	mg/kg-day	7.2E-01	$(mg/kg\text{-}day)^{-1}$	9.21E-04	9.84E-04	mg/kg-day	3.0E-03	mg/kg-day	3.28E-01
				Semi-volatile Organic Compounds												
				1,4-Dioxane	2.16E+01	µg/L	2.77E-04	mg/kg-day	1.0E-01	$(mg/kg\text{-}day)^{-1}$	2.77E-05	1.07E-03	mg/kg-day	3.0E-02	mg/kg-day	3.58E-02
				2,3,4,6-Tetrachlorophenol	1.10E+02	µg/L	1.41E-03	mg/kg-day	NA	NA	NA	5.48E-03	mg/kg-day	3.0E-02	mg/kg-day	1.83E-01
				Benzo(a)anthracene	3.50E-02	µg/L	1.40E-06	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	1.02E-06	1.75E-06	mg/kg-day	NA	NA	NA
				Benzo(b)fluoranthene	1.50E-01	µg/L	5.99E-06	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	4.37E-06	7.48E-06	mg/kg-day	NA	NA	NA
				Bis(2-Ethylhexyl)Phthalate	6.05E+00	µg/L	7.76E-05	mg/kg-day	1.4E-02	$(mg/kg\text{-}day)^{-1}$	1.09E-06	3.01E-04	mg/kg-day	2.0E-02	mg/kg-day	1.51E-02
				Naphthalene	1.28E-01	µg/L	1.64E-06	mg/kg-day	NA	NA	NA	6.38E-06	mg/kg-day	2.0E-02	mg/kg-day	3.19E-04
				Inorganics												
				Antimony	5.20E+00	µg/L	6.67E-05	mg/kg-day	NA	NA	NA	2.59E-04	mg/kg-day	4.0E-04	mg/kg-day	6.48E-01
				Chromium	3.82E+01	µg/L	4.90E-04	mg/kg-day	5.0E-01	$(mg/kg\text{-}day)^{-1}$	2.45E-04	1.90E-03	mg/kg-day	3.0E-03	mg/kg-day	6.35E-01
				Cobalt	1.42E+01	µg/L	1.82E-04	mg/kg-day	NA	NA	NA	7.06E-04	mg/kg-day	3.0E-04	mg/kg-day	2.35E+00
				Iron	2.13E+04	µg/L	2.73E-01	mg/kg-day	NA	NA	NA	1.06E+00	mg/kg-day	7.0E-01	mg/kg-day	1.52E+00
				Lead	1.02E+01	µg/L	1.30E-04	mg/kg-day	NA	NA	NA	5.06E-04	mg/kg-day	NA	NA	NA
				Manganese	3.90E+03	µg/L	5.01E-02	mg/kg-day	NA	NA	NA	1.95E-01	mg/kg-day	1.4E-01	mg/kg-day	1.39E+00
				Nickel	2.61E+01	µg/L	3.35E-04	mg/kg-day	NA	NA	NA	1.30E-03	mg/kg-day	2.0E-02	mg/kg-day	6.51E-02
				Thallium	6.30E-02	µg/L	8.09E-07	mg/kg-day	NA	NA	NA	3.14E-06	mg/kg-day	1.0E-05	mg/kg-day	3.14E-01
			Exp. Route Total								1.36E-03					2.78E+01
Groundwater	Groundwater	Tap Water	Dermal Contact	**Volatile Organic Compounds**												
				1,1,2,2-Tetrachloroethane	2.40E-01	µg/L	3.85E-07	mg/kg-day	2.0E-01	$(mg/kg\text{-}day)^{-1}$	7.70E-08	1.47E-06	mg/kg-day	2.0E-02	mg/kg-day	7.37E-05
				1,1-Dichloroethane	2.71E+01	µg/L	2.70E-05	mg/kg-day	5.7E-03	$(mg/kg\text{-}day)^{-1}$	1.54E-07	1.03E-04	mg/kg-day	2.0E-01	mg/kg-day	5.16E-04
				1,2,3-Trichlorobenzene	8.50E+00	µg/L	NA	NA	NA	NA	NA	NA	NA	8.0E-04	mg/kg-day	NA
				1,2-Dichloroethane	2.87E-01	µg/L	1.79E-07	mg/kg-day	9.1E-02	$(mg/kg\text{-}day)^{-1}$	1.63E-08	6.86E-07	mg/kg-day	6.0E-03	mg/kg-day	1.14E-04
				1,4-Dichlorobenzene	1.02E+01	µg/L	8.69E-05	mg/kg-day	5.4E-03	$(mg/kg\text{-}day)^{-1}$	4.69E-07	3.33E-04	mg/kg-day	7.0E-02	mg/kg-day	4.75E-03
				Benzene	8.15E-01	µg/L	1.59E-06	mg/kg-day	5.5E-02	$(mg/kg\text{-}day)^{-1}$	8.73E-08	6.08E-06	mg/kg-day	4.0E-03	mg/kg-day	1.52E-03
				Bromodichloromethane	4.69E-01	µg/L	4.88E-07	mg/kg-day	6.2E-02	$(mg/kg\text{-}day)^{-1}$	3.03E-08	1.87E-06	mg/kg-day	2.0E-02	mg/kg-day	9.34E-05
				Chlorobenzene	3.15E+01	µg/L	1.44E-04	mg/kg-day	NA	NA	NA	5.53E-04	mg/kg-day	2.0E-02	mg/kg-day	2.76E-02
				Chloroform	3.33E+00	µg/L	3.86E-06	mg/kg-day	3.1E-02	$(mg/kg\text{-}day)^{-1}$	1.20E-07	1.48E-05	mg/kg-day	1.0E-02	mg/kg-day	1.48E-03
				cis-1,2-Dichloroethene	5.31E+01	µg/L	NA	NA	NA	NA	NA	NA	NA	2.0E-03	mg/kg-day	NA
				Trichloroethene	1.84E+02	µg/L	See Table B-7.0.9	NA	4.6E-02	$(mg/kg\text{-}day)^{-1}$	2.58E-05	1.55E-03	mg/kg-day	5.0E-04	mg/kg-day	3.11E+00
				Vinyl Chloride	1.97E+01	µg/L	6.76E-05	mg/kg-day	7.2E-01	$(mg/kg\text{-}day)^{-1}$	4.87E-05	5.19E-05	mg/kg-day	3.0E-03	mg/kg-day	1.73E-02
				Semi-volatile Organic Compounds												
				1,4-Dioxane	2.16E+01	µg/L	9.85E-07	mg/kg-day	1.0E-01	$(mg/kg\text{-}day)^{-1}$	9.85E-08	3.77E-06	mg/kg-day	3.0E-02	mg/kg-day	1.26E-04

TABLE H-7.1
CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Resident
Receptor Age:	Child/Lifetime[1]

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	Exposure Point Concentration		Cancer Risk Calculation					Noncancer Hazard Calculation				
							Intake/ Exposure Concentration		Slope Factor/Unit Risk		Cancer	Intake/ Exposure Concentration		RfD/RfC		Hazard
					Value	Unit	Value	Unit	Value	Unit	Risk	Value	Unit	Value	Unit	Quotient
				2,3,4,6-Tetrachlorophenol	1.10E+02	µg/L	NA	NA	NA	NA	NA	NA	NA	3.0E-02	mg/kg-day	NA
				Benzo(a)anthracene	3.50E-02	µg/L	1.75E-05	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	1.28E-05	2.16E-05	mg/kg-day	NA	NA	NA
				Benzo(b)fluoranthene	1.50E-01	µg/L	1.30E-04	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	9.52E-05	1.61E-04	mg/kg-day	NA	NA	NA
				Bis(2-Ethylhexyl)Phthalate	6.05E+00	µg/L	1.19E-04	mg/kg-day	1.4E-02	$(mg/kg\text{-}day)^{-1}$	1.66E-06	4.55E-04	mg/kg-day	2.0E-02	mg/kg-day	2.28E-02
				Naphthalene	1.28E-01	µg/L	1.09E-06	mg/kg-day	NA	NA	NA	4.16E-06	mg/kg-day	2.0E-02	mg/kg-day	2.08E-04
				Inorganics												
				Antimony	5.20E+00	µg/L	3.72E-07	mg/kg-day	NA	NA	NA	1.42E-06	mg/kg-day	6.0E-05	mg/kg-day	2.37E-02
				Chromium	3.82E+01	µg/L	5.46E-06	mg/kg-day	2.0E+01		1.09E-04	2.09E-05	mg/kg-day	7.5E-05	mg/kg-day	2.79E-01
				Cobalt	1.42E+01	µg/L	4.04E-07	mg/kg-day	NA	NA	NA	1.55E-06	mg/kg-day	3.0E-04	mg/kg-day	5.16E-03
				Iron	2.13E+04	µg/L	1.52E-03	mg/kg-day	NA		NA	5.83E-03	mg/kg-day	7.0E-01	mg/kg-day	8.32E-03
				Lead	1.02E+01	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	3.90E+03	µg/L	2.79E-04	mg/kg-day	NA	NA	NA	1.07E-03	mg/kg-day	1.4E-01	mg/kg-day	7.63E-03
				Nickel	2.61E+01	µg/L	3.73E-07	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NA	1.43E-06	mg/kg-day	8.0E-04	mg/kg-day	1.79E-03
				Thallium	6.30E-02	µg/L	4.50E-09	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NA	1.72E-08	mg/kg-day	1.0E-05	mg/kg-day	1.72E-03
			Exp. Route Total								2.94E-04					3.51E+00
Groundwater	Groundwater	Tap Water	Inhalation	**Volatile Organic Compounds**												
				1,1,2,2-Tetrachloroethane	2.40E-01	µg/L	6.79E-02	$µg/m^3$	5.8E-05	$(µg/m^3)^{-1}$	3.94E-06	1.40E-04	mg/m^3	NA	mg/m^3	NA
				1,1-Dichloroethane	2.71E+01	µg/L	8.38E+00	$µg/m^3$	1.6E-06	$(µg/m^3)^{-1}$	1.34E-05	1.73E-02	mg/m^3	NA	NA	NA
				1,2,3-Trichlorobenzene	8.50E+00	µg/L	2.25E+00	$µg/m^3$	NA	NA	NA	4.63E-03	mg/m^3	NA	NA	NA
				1,2-Dichloroethane	2.87E-01	µg/L	9.10E-02	$µg/m^3$	2.6E-05	$(µg/m^3)^{-1}$	2.37E-06	1.88E-04	mg/m^3	7.0E-03	mg/m^3	2.68E-02
				1,4-Dichlorobenzene	1.02E+01	µg/L	2.75E+00	$µg/m^3$	1.1E-05	$(µg/m^3)^{-1}$	3.03E-05	5.68E-03	mg/m^3	8.0E-01	mg/m^3	7.10E-03
				Benzene	8.15E-01	µg/L	2.47E-01	$µg/m^3$	7.8E-06	$(µg/m^3)^{-1}$	1.93E-06	5.10E-04	mg/m^3	3.0E-02	mg/m^3	1.70E-02
				Bromodichloromethane	4.69E-01	µg/L	1.46E-01	$µg/m^3$	3.7E-05	$(µg/m^3)^{-1}$	5.40E-06	3.01E-04	mg/m^3	NA	NA	NA
				Chlorobenzene	3.15E+01	µg/L	9.05E+00	$µg/m^3$	NA	NA	NA	1.87E-02	mg/m^3	5.0E-02	mg/m^3	3.73E-01
				Chloroform	3.33E+00	µg/L	1.05E+00	$µg/m^3$	2.3E-05	$(µg/m^3)^{-1}$	2.41E-05	2.16E-03	mg/m^3	3.0E-01	mg/m^3	7.20E-03
				cis-1,2-Dichloroethene	5.31E+01	µg/L	1.71E+01	$µg/m^3$	NA	NA	NA	3.53E-02	mg/m^3	NA	NA	NA
				Trichloroethene	1.84E+02	µg/L	See Table B-7.0.9	NA	4.1E-06	$(µg/m^3)^{-1}$	3.16E-04	1.14E-01	mg/m^3	2.0E-03	mg/m^3	5.72E+01
				Vinyl Chloride	1.97E+01	µg/L	6.41E+02	$µg/m^3$	4.4E-06	$(µg/m^3)^{-1}$	2.82E-03	1.37E-02	mg/m^3	1.0E-01	mg/m^3	1.37E-01
			Exp. Route Total								3.22E-03					5.78E+01
		Exposure Point Total									4.87E-03					8.92E+01

[1] Noncancer hazards presented for the child receptor (birth to <6 years); cancer risks presented for the lifetime receptor.

RfD = reference dose
NA = not applicable

mg/kg = milligram per kilogram
mg/kg-day = milligram per kilogram per day

$µg/m^3$ = microgram per cubic meter
mg/m^3 = milligram per cubic meter

TABLE H-7.2
CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

Scenario Timeframe:	Future
Receptor Population:	Resident
Receptor Age:	Adult/Lifetime[1]

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	Exposure Point Concentration		Cancer Risk Calculation					Adult Noncancer Hazard Calculation				
							Intake/ Exposure Concentration		Slope Factor/Unit Risk		Cancer	Intake/ Exposure Concentration		RfD/RfC		Hazard
					Value	Unit	Value	Unit	Value	Unit	Risk	Value	Unit	Value	Unit	Quotient
Groundwater	Groundwater	Tap Water	Ingestion	**Volatile Organic Compounds**												
				1,1,2,2-Tetrachloroethane	2.40E-01	µg/L	3.08E-06	mg/kg-day	2.0E-01	$(mg/kg-day)^{-1}$	6.16E-07	7.19E-06	mg/kg-day	2.0E-02	mg/kg-day	3.60E-04
				1,1-Dichloroethane	2.71E+01	µg/L	3.48E-04	mg/kg-day	5.7E-03	$(mg/kg-day)^{-1}$	1.98E-06	8.12E-04	mg/kg-day	2.0E-01	mg/kg-day	4.06E-03
				1,2,3-Trichlorobenzene	8.50E+00	µg/L	1.09E-04	mg/kg-day	NA	NA	NA	2.55E-04	mg/kg-day	8.0E-04	mg/kg-day	3.18E-01
				1,2-Dichloroethane	2.87E-01	µg/L	3.68E-06	mg/kg-day	9.1E-02	$(mg/kg-day)^{-1}$	3.35E-07	8.60E-06	mg/kg-day	6.0E-03	mg/kg-day	1.43E-03
				1,4-Dichlorobenzene	1.02E+01	µg/L	1.31E-04	mg/kg-day	5.4E-03	$(mg/kg-day)^{-1}$	7.06E-07	3.05E-04	mg/kg-day	7.0E-02	mg/kg-day	4.36E-03
				Benzene	8.15E-01	µg/L	1.05E-05	mg/kg-day	5.5E-02	$(mg/kg-day)^{-1}$	5.75E-07	2.44E-05	mg/kg-day	4.0E-03	mg/kg-day	6.11E-03
				Bromodichloromethane	4.69E-01	µg/L	6.02E-06	mg/kg-day	6.2E-02	$(mg/kg-day)^{-1}$	3.73E-07	1.41E-05	mg/kg-day	2.0E-02	mg/kg-day	7.03E-04
				Chlorobenzene	3.15E+01	µg/L	4.05E-04	mg/kg-day	NA	NA	NA	9.45E-04	mg/kg-day	2.0E-02	mg/kg-day	4.73E-02
				Chloroform	3.33E+00	µg/L	4.27E-05	mg/kg-day	3.1E-02	$(mg/kg-day)^{-1}$	1.32E-06	9.97E-05	mg/kg-day	1.0E-02	mg/kg-day	9.97E-03
				cis-1,2-Dichloroethene	5.31E+01	µg/L	6.81E-04	mg/kg-day	NA	NA	NA	1.59E-03	mg/kg-day	2.0E-03	mg/kg-day	7.95E-01
				Trichloroethene	1.84E+02	µg/L	See Table B-7.0.9	NA	4.6E-02	$(mg/kg-day)^{-1}$	1.55E-04	5.52E-03	mg/kg-day	5.0E-04	mg/kg-day	1.10E+01
				Vinyl Chloride	1.97E+01	µg/L	1.28E-03	mg/kg-day	7.2E-01	$(mg/kg-day)^{-1}$	9.21E-04	5.92E-04	mg/kg-day	3.0E-03	mg/kg-day	1.97E-01
				Semi-volatile Organic Compounds												
				1,4-Dioxane	2.16E+01	µg/L	2.77E-04	mg/kg-day	1.0E-01	$(mg/kg-day)^{-1}$	2.77E-05	6.46E-04	mg/kg-day	3.0E-02	mg/kg-day	2.15E-02
				2,3,4,6-Tetrachlorophenol	1.10E+02	µg/L	1.41E-03	mg/kg-day	NA	NA	NA	3.30E-03	mg/kg-day	3.0E-02	mg/kg-day	1.10E-01
				Benzo(a)anthracene	3.50E-02	µg/L	1.40E-06	mg/kg-day	7.3E-01	$(mg/kg-day)^{-1}$	1.02E-06	1.05E-06	mg/kg-day	NA	NA	NA
				Benzo(b)fluoranthene	1.50E-01	µg/L	5.99E-06	mg/kg-day	7.3E-01	$(mg/kg-day)^{-1}$	4.37E-06	4.49E-06	mg/kg-day	NA	NA	NA
				Bis(2-Ethylhexyl)Phthalate	6.05E+00	µg/L	7.76E-05	mg/kg-day	1.4E-02	$(mg/kg-day)^{-1}$	1.09E-06	1.81E-04	mg/kg-day	2.0E-02	mg/kg-day	9.06E-03
				Naphthalene	1.28E-01	µg/L	1.64E-06	mg/kg-day	NA	NA	NA	3.84E-06	mg/kg-day	2.0E-02	mg/kg-day	1.92E-04
				Inorganics												
				Antimony	5.20E+00	µg/L	6.67E-05	mg/kg-day	NA	NA	NA	1.56E-04	mg/kg-day	4.0E-04	mg/kg-day	3.90E-01
				Chromium	3.82E+01	µg/L	4.90E-04	mg/kg-day	5.0E-01	$(mg/kg-day)^{-1}$	2.45E-04	1.14E-03	mg/kg-day	3.0E-03	mg/kg-day	3.82E-01
				Cobalt	1.42E+01	µg/L	1.82E-04	mg/kg-day	NA	NA	NA	4.24E-04	mg/kg-day	3.0E-04	mg/kg-day	1.41E+00
				Iron	2.13E+04	µg/L	2.73E-01	mg/kg-day	NA	NA	NA	6.38E-01	mg/kg-day	7.0E-01	mg/kg-day	9.12E-01
				Lead	1.02E+01	µg/L	1.30E-04	mg/kg-day	NA	NA	NA	3.04E-04	mg/kg-day	NA	NA	NA
				Manganese	3.90E+03	µg/L	5.01E-02	mg/kg-day	NA	NA	NA	1.17E-01	mg/kg-day	1.4E-01	mg/kg-day	8.36E-01
				Nickel	2.61E+01	µg/L	3.35E-04	mg/kg-day	NA	NA	NA	7.83E-04	mg/kg-day	2.0E-02	mg/kg-day	3.92E-02
				Thallium	6.30E-02	µg/L	8.09E-07	mg/kg-day	NA	NA	NA	1.89E-06	mg/kg-day	1.0E-05	mg/kg-day	1.89E-01
			Exp. Route Total								1.36E-03					1.65E+01
Groundwater	Groundwater	Groundwater	Dermal	**Volatile Organic Compounds**												
			Contact	1,1,2,2-Tetrachloroethane	2.40E-01	µg/L	3.85E-07	mg/kg-day	2.0E-01	$(mg/kg-day)^{-1}$	7.70E-08	9.06E-07	mg/kg-day	2.0E-02	mg/kg-day	4.53E-05
				1,1-Dichloroethane	2.71E+01	µg/L	2.70E-05	mg/kg-day	5.7E-03	$(mg/kg-day)^{-1}$	1.54E-07	6.34E-05	mg/kg-day	2.0E-01	mg/kg-day	3.17E-04
				1,2,3-Trichlorobenzene	8.50E+00	µg/L	NA	NA	NA	NA	NA	NA	NA	8.0E-04	mg/kg-day	NA
				1,2-Dichloroethane	2.87E-01	µg/L	1.79E-07	mg/kg-day	9.1E-02	$(mg/kg-day)^{-1}$	1.63E-08	4.21E-07	mg/kg-day	6.0E-03	mg/kg-day	7.02E-05
				1,4-Dichlorobenzene	1.02E+01	µg/L	8.69E-05	mg/kg-day	5.4E-03	$(mg/kg-day)^{-1}$	4.69E-07	2.04E-04	mg/kg-day	7.0E-02	mg/kg-day	2.92E-03
				Benzene	8.15E-01	µg/L	1.59E-06	mg/kg-day	5.5E-02	$(mg/kg-day)^{-1}$	8.73E-08	3.73E-06	mg/kg-day	4.0E-03	mg/kg-day	9.33E-04
				Bromodichloromethane	4.69E-01	µg/L	4.88E-07	mg/kg-day	6.2E-02	$(mg/kg-day)^{-1}$	3.03E-08	1.15E-06	mg/kg-day	2.0E-02	mg/kg-day	5.74E-05
				Chlorobenzene	3.15E+01	µg/L	1.44E-04	mg/kg-day	NA	NA	NA	3.40E-04	mg/kg-day	2.0E-02	mg/kg-day	1.70E-02
				Chloroform	3.33E+00	µg/L	3.86E-06	mg/kg-day	3.1E-02	$(mg/kg-day)^{-1}$	1.20E-07	9.07E-06	mg/kg-day	1.0E-02	mg/kg-day	9.07E-04
				cis-1,2-Dichloroethene	5.31E+01	µg/L	NA	NA	NA	NA	NA	NA	NA	2.0E-03	mg/kg-day	NA
				Trichloroethene	1.84E+02	µg/L	See Table B-7.0.9	NA	4.6E-02	$(mg/kg-day)^{-1}$	2.58E-05	9.55E-04	mg/kg-day	5.0E-04	mg/kg-day	1.91E+00
				Vinyl Chloride	1.97E+01	µg/L	6.76E-05	mg/kg-day	7.2E-01	$(mg/kg-day)^{-1}$	4.87E-05	3.19E-05	mg/kg-day	3.0E-03	mg/kg-day	1.06E-02
				Semi-volatile Organic Compounds												
				1,4-Dioxane	2.16E+01	µg/L	9.85E-07	mg/kg-day	1.0E-01	$(mg/kg-day)^{-1}$	9.85E-08	2.32E-06	mg/kg-day	3.0E-02	mg/kg-day	7.72E-05
				2,3,4,6-Tetrachlorophenol	1.10E+02	µg/L	NA	NA	NA	NA	NA	NA	NA	3.0E-02	mg/kg-day	NA
				Benzo(a)anthracene	3.50E-02	µg/L	1.75E-05	mg/kg-day	7.3E-01	$(mg/kg-day)^{-1}$	1.28E-05	1.33E-05	mg/kg-day	NA	NA	NA
				Benzo(b)fluoranthene	1.50E-01	µg/L	1.30E-04	mg/kg-day	7.3E-01	$(mg/kg-day)^{-1}$	9.52E-05	9.91E-05	mg/kg-day	NA	NA	NA

TABLE H-7.2
CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

Scenario Timeframe:	Future
Receptor Population:	Resident
Receptor Age:	Adult/Lifetime[1]

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	Exposure Point Concentration		Cancer Risk Calculation					Adult Noncancer Hazard Calculation				
							Intake/ Exposure Concentration		Slope Factor/Unit Risk		Cancer	Intake/ Exposure Concentration		RfD/RfC		Hazard
					Value	Unit	Value	Unit	Value	Unit	Risk	Value	Unit	Value	Unit	Quotient
				Bis(2-Ethylhexyl)Phthalate	6.05E+00	µg/L	1.19E-04	mg/kg-day	1.4E-02	$(mg/kg\text{-}day)^{-1}$	1.66E-06	2.80E-04	mg/kg-day	2.0E-02	mg/kg-day	1.40E-02
				Naphthalene	1.28E-01	µg/L	1.09E-06	mg/kg-day	NA	NA	NA	2.55E-06	mg/kg-day	2.0E-02	mg/kg-day	1.28E-04
				Inorganics												
				Antimony	5.20E+00	µg/L	3.72E-07	mg/kg-day	NA	NA	NA	8.74E-07	mg/kg-day	6.0E-05	mg/kg-day	1.46E-02
				Chromium	3.82E+01	µg/L	5.46E-06	mg/kg-day	2.0E+01	$(mg/kg\text{-}day)^{-1}$	1.09E-04	1.28E-05	mg/kg-day	7.5E-05	mg/kg-day	1.71E-01
				Cobalt	1.42E+01	µg/L	4.04E-07	mg/kg-day	NA	NA	NA	9.51E-07	mg/kg-day	3.0E-04	mg/kg-day	3.17E-03
				Iron	2.13E+04	µg/L	1.52E-03	mg/kg-day	NA	NA	NA	3.58E-03	mg/kg-day	7.0E-01	mg/kg-day	5.11E-03
				Lead	1.02E+01	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	3.90E+03	µg/L	2.79E-04	mg/kg-day	NA	NA	NA	6.56E-04	mg/kg-day	1.4E-01	mg/kg-day	4.69E-03
				Nickel	2.61E+01	µg/L	3.73E-07	mg/kg-day	NA	NA	NA	8.78E-07	mg/kg-day	8.0E-04	mg/kg-day	1.10E-03
				Thallium	6.30E-02	µg/L	4.50E-09	mg/kg-day	NA	NA	NA	1.06E-08	mg/kg-day	1.0E-05	mg/kg-day	1.06E-03
			Exp. Route Total								2.94E-04					2.16E+00
Groundwater	Groundwater	Groundwater	Inhalation	**Volatile Organic Compounds**												
				1,1,2,2-Tetrachloroethane	2.40E-01	µg/L	6.79E-02	$µg/m^3$	5.8E-05	$(µg/m^3)^{-1}$	3.94E-06	1.96E-04	mg/m^3	NA	NA	NA
				1,1-Dichloroethane	2.71E+01	µg/L	8.38E+00	$µg/m^3$	1.6E-06	$(µg/m^3)^{-1}$	1.34E-05	2.41E-02	mg/m^3	NA	NA	NA
				1,2,3-Trichlorobenzene	8.50E+00	µg/L	2.25E+00	$µg/m^3$	NA	NA	NA	6.47E-03	mg/m^3	NA	NA	NA
				1,2-Dichloroethane	2.87E-01	µg/L	9.10E-02	$µg/m^3$	2.6E-05	$(µg/m^3)^{-1}$	2.37E-06	2.62E-04	mg/m^3	7.0E-03	mg/m^3	3.75E-02
				1,4-Dichlorobenzene	1.02E+01	µg/L	2.75E+00	$µg/m^3$	1.1E-05	$(µg/m^3)^{-1}$	3.03E-05	7.93E-03	mg/m^3	8.0E-01	mg/m^3	9.92E-03
				Benzene	8.15E-01	µg/L	2.47E-01	$µg/m^3$	7.8E-06	$(µg/m^3)^{-1}$	1.93E-06	7.12E-04	mg/m^3	3.0E-02	mg/m^3	2.37E-02
				Bromodichloromethane	4.69E-01	µg/L	1.46E-01	$µg/m^3$	3.7E-05	$(µg/m^3)^{-1}$	5.40E-06	4.21E-04	mg/m^3	NA	NA	NA
				Chlorobenzene	3.15E+01	µg/L	9.05E+00	$µg/m^3$	NA	NA	NA	2.61E-02	mg/m^3	5.0E-02	mg/m^3	5.21E-01
				Chloroform	3.33E+00	µg/L	1.05E+00	$µg/m^3$	2.3E-05	$(µg/m^3)^{-1}$	2.41E-05	3.02E-03	mg/m^3	3.0E-01	mg/m^3	1.01E-02
				cis-1,2-Dichloroethene	5.31E+01	µg/L	1.71E+01	$µg/m^3$	NA	NA	NA	4.94E-02	mg/m^3	NA	NA	NA
				Trichloroethene	1.84E+02	µg/L	See Table B-7.0.9	NA	4.1E-06	$(µg/m^3)^{-1}$	3.16E-04	1.60E-01	mg/m^3	2.0E-03	mg/m^3	8.00E+01
				Vinyl Chloride	1.97E+01	µg/L	6.41E+02	$µg/m^3$	4.4E-06	$(µg/m^3)^{-1}$	2.82E-03	1.91E-02	mg/m^3	1.0E-01	mg/m^3	1.91E-01
			Exp. Route Total								3.22E-03					8.08E+01
		Exposure Point Total									4.87E-03					9.95E+01

[1] Noncancer hazards presented for the adult receptor; cancer risks presented for the lifetime receptor.

RfD = reference dose
NA = not applicable
mg/kg = milligram per kilogram
mg/kg-day = milligram per kilogram per day
$µg/m^3$ = microgram per cubic meter
mg/m^3 = milligram per cubic meter

TABLE H-9.1
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Resident
Receptor Age:	Child/Lifetime[1]

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Groundwater	Groundwater	Tap Water	**Volatile Organic Compounds**									
			1,1,2,2-Tetrachloroethane	6E-07	8E-08	4E-06	5E-06	Liver	6E-04	7E-05	NA	7E-04
			1,1-Dichloroethane	2E-06	2E-07	1E-05	2E-05	Kidney	7E-03	5E-04	NA	7E-03
			1,2,3-Trichlorobenzene	NA	NA	NA	NA	Body Weight/Liver/Thyroid	5E-01	NA	NA	5E-01
			1,2-Dichloroethane	3E-07	2E-08	2E-06	3E-06	Liver/Kidney	2E-03	1E-04	3E-02	3E-02
			1,4-Dichlorobenzene	7E-07	5E-07	3E-05	3E-05	Liver	7E-03	5E-03	7E-03	2E-02
			Benzene	6E-07	9E-08	2E-06	3E-06	Blood	1E-02	2E-03	2E-02	3E-02
			Bromodichloromethane	4E-07	3E-08	5E-06	6E-06	Liver	1E-03	9E-05	NA	1E-03
			Chlorobenzene	NA	NA	NA	NA	Liver/Kidney	8E-02	3E-02	4E-01	5E-01
			Chloroform	1E-06	1E-07	2E-05	3E-05	Liver/Alimentary System/ Kidney/Developmental	2E-02	1E-03	7E-03	3E-02
			cis-1,2-Dichloroethene	NA	NA	NA	NA	Kidney	1E+00	NA	NA	1E+00
			Trichloroethene	2E-04	3E-05	3E-04	5E-04	Heart/ Immune System/ Developmental/Kidney/Liver	2E+01	3E+00	6E+01	8E+01
			Vinyl Chloride	9E-04	5E-05	3E-03	4E-03	Liver	3E-01	2E-02	1E-01	5E-01
			Semi-volatile Organic Compounds									
			1,4-Dioxane	3E-05	1E-07	NA	3E-05	Liver/Kidney/CNS/Respiratory System	4E-02	1E-04	NA	4E-02
			2,3,4,6-Tetrachlorophenol	NA	NA	NA	NA	Liver	2E-01	NA	NA	2E-01
			Benzo(a)anthracene	1E-06	1E-05	NA	1E-05	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	4E-06	1E-04	NA	1E-04	NA	NA	NA	NA	NA
			Bis(2-Ethylhexyl)Phthalate	1E-06	2E-06	NA	3E-06	Liver	2E-02	2E-02	NA	4E-02
			Naphthalene	NA	NA	NA	NA	Body Weight/CNS/Respiratory System	3E-04	2E-04	NA	5E-04
			Inorganics									
			Antimony	NA	NA	NA	NA	Longevity/Blood/Lung	6E-01	2E-02	NA	7E-01
			Chromium	2E-04	1E-04	NA	4E-04	Lung	6E-01	3E-01	NA	9E-01
			Cobalt	NA	NA	NA	NA	Thyroid/Respiratory System/ Lung	2E+00	5E-03	NA	2E+00
			Iron	NA	NA	NA	NA	GI Tract	2E+00	8E-03	NA	2E+00
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	CNS	1E+00	8E-03	NA	1E+00
			Nickel	NA	NA	NA	NA	Body and Organ Weight/Respiratory System	7E-02	2E-03	NA	7E-02
			Thallium	NA	NA	NA	NA	Skin/Hair	3E-01	2E-03	NA	3E-01
			Chemical Total	1E-03	3E-04	3E-03	5E-03	Chemical Total	3E+01	4E+00	6E+01	9E+01
		Exposure Point Total					5E-03					9E+01
	Exposure Medium Total						5E-03					9E+01
Medium Total							5E-03					9E+01
Receptor Total							5E-03					9E+01

Total Excess Cancer Risk Across All Media: 5E-03

Total Hazard Index (HI) Across All Media: 89

TABLE H-9.1
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Resident
Receptor Age:	Child/Lifetime[1]

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total

[1] Noncancer hazards presented for the child receptor (birth to <6 years); cancer risks presented for the lifetime receptor.

Alimentary System HI Across All Media =	0.03
Blood HI Across All Media =	0.7
Body and Organ Weight HI Across All Media =	0.07
Body weight HI Across All Media =	0.5
CNS HI Across All Media =	1
Development HI Across All Media =	79
GI Tract HI Across All Media =	2
Hair HI Across All Media =	0.3
Heart HI Across All Media =	79
Immune system HI Across All Media =	79
Kidney HI Across All Media =	81
Liver HI Across All Media =	81
Longevity HI Across All Media =	0.7
Lung HI Across All Media =	4
Respiratory System HI Across All Media =	2
Skin HI Across All Media =	0.3
Thyroid HI Across All Media =	3

NA = not applicable CNS = central nervous system GI = gastrointestinal

TABLE H-9.2
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

Scenario Timeframe:	Future
Receptor Population:	Resident
Receptor Age:	Adult/Lifetime[1]

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Adult Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Groundwater	Groundwater	Tap Water	**Volatile Organic Compounds**									
			1,1,2,2-Tetrachloroethane	6E-07	8E-08	4E-06	5E-06	Liver	4E-04	5E-05	NA	4E-04
			1,1-Dichloroethane	2E-06	2E-07	1E-05	2E-05	Kidney	4E-03	3E-04	NA	4E-03
			1,2,3-Trichlorobenzene	NA	NA	NA	NA	Body Weight/Liver/Thyroid	3E-01	NA	NA	3E-01
			1,2-Dichloroethane	3E-07	2E-08	2E-06	3E-06	Liver/Kidney	1E-03	7E-05	4E-02	4E-02
			1,4-Dichlorobenzene	7E-07	5E-07	3E-05	3E-05	Liver	4E-03	3E-03	1E-02	2E-02
			Benzene	6E-07	9E-08	2E-06	3E-06	Blood	6E-03	9E-04	2E-02	3E-02
			Bromodichloromethane	4E-07	3E-08	5E-06	6E-06	Liver	7E-04	6E-05	NA	8E-04
			Chlorobenzene	NA	NA	NA	NA	Liver/Kidney	5E-02	2E-02	5E-01	6E-01
			Chloroform	1E-06	1E-07	2E-05	3E-05	Liver/Alimentary System/ Kidney/Developmental	1E-02	9E-04	1E-02	2E-02
			cis-1,2-Dichloroethene	NA	NA	NA	NA	Kidney	8E-01	NA	NA	8E-01
			Trichloroethene	2E-04	3E-05	3E-04	5E-04	Heart/ Immune System/ Developmental/Kidney/Liver	1E+01	2E+00	8E+01	9E+01
			Vinyl Chloride	9E-04	5E-05	3E-03	4E-03	Liver	2E-01	1E-02	2E-01	4E-01
			Semi-volatile Organic Compounds									
			1,4-Dioxane	3E-05	1E-07	NA	3E-05	Liver/Kidney/CNS/Respiratory System	2E-02	8E-05	NA	2E-02
			2,3,4,6-Tetrachlorophenol	NA	NA	NA	NA	Liver	1E-01	NA	NA	1E-01
			Benzo(a)anthracene	1E-06	1E-05	NA	1E-05	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	4E-06	1E-04	NA	1E-04	NA	NA	NA	NA	NA
			Bis(2-Ethylhexyl)Phthalate	1E-06	2E-06	NA	3E-06	Liver	9E-03	1E-02	NA	2E-02
			Naphthalene	NA	NA	NA	NA	Body Weight/CNS/Respiratory System	2E-04	1E-04	NA	3E-04
			Inorganics									
			Antimony	NA	NA	NA	NA	Longevity/Blood/Lung	4E-01	1E-02	NA	4E-01
			Chromium	2E-04	1E-04	NA	4E-04	Lung	4E-01	2E-01	NA	6E-01
			Cobalt	NA	NA	NA	NA	Thyroid/Respiratory System/ Lung	1E+00	3E-03	NA	1E+00
			Iron	NA	NA	NA	NA	GI Tract	9E-01	5E-03	NA	9E-01
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	CNS	8E-01	5E-03	NA	8E-01
			Nickel	NA	NA	NA	NA	Body and Organ Weight/Respiratory System	4E-02	1E-03	NA	4E-02
			Thallium	NA	NA	NA	NA	Skin/Hair	2E-01	1E-03	NA	2E-01
			Chemical Total	1E-03	3E-04	3E-03	5E-03	Chemical Total	2E+01	2E+00	8E+01	1E+02
		Exposure Point Total					5E-03					1E+02
	Exposure Medium Total						5E-03					1E+02
Medium Total							5E-03					1E+02
Receptor Total							5E-03					1E+02

Total Excess Cancer Risk Across All Media	5E-03
Total Hazard Index (HI) Across All Media	100

[1] Noncancer hazards presented for the adult receptor; cancer risks presented for the lifetime receptor.

Alimentary System HI Across All Media =	0.02
Blood HI Across All Media =	0.4
Body and Organ Weight HI Across All Media =	0.04
Body weight HI Across All Media =	0.3
CNS HI Across All Media =	0.9
Development HI Across All Media =	93
GI Tract HI Across All Media =	0.9
Hair HI Across All Media =	0.2
Heart HI Across All Media =	93
Immune system HI Across All Media =	93
Kidney HI Across All Media =	94
Liver HI Across All Media =	94
Longevity HI Across All Media =	0.4
Lung HI Across All Media =	2
Respiratory System HI Across All Media =	1
Skin HI Across All Media =	0.2
Thyroid HI Across All Media =	2

NA = not applicable CNS = central nervous system GI = gastrointestinal

TABLE H-10.1
RISK ASSESSMENT SUMMARY
REASONABLE MAXIMUM EXPOSURE
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Resident
Receptor Age:	Child/Lifetime[1]

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Child Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Groundwater	Groundwater	Tap Water	**Volatile Organic Compounds**									
			1,1,2,2-Tetrachloroethane	6E-07	8E-08	4E-06	5E-06	Liver	6E-04	7E-05	NA	7E-04
			1,1-Dichloroethane	2E-06	2E-07	1E-05	2E-05	Kidney	7E-03	5E-04	NA	7E-03
			1,2-Dichloroethane	3E-07	2E-08	2E-06	3E-06	Liver/Kidney	2E-03	1E-04	3E-02	3E-02
			1,4-Dichlorobenzene	7E-07	5E-07	3E-05	3E-05	Liver	7E-03	5E-03	7E-03	2E-02
			Benzene	6E-07	9E-08	2E-06	3E-06	Blood	1E-02	2E-03	2E-02	3E-02
			Bromodichloromethane	4E-07	3E-08	5E-06	6E-06	Liver	1E-03	9E-05	NA	1E-03
			Chloroform	1E-06	1E-07	2E-05	3E-05	Liver/Alimentary System/ Kidney/Developmental	2E-02	1E-03	7E-03	3E-02
			cis-1,2-Dichloroethene	NA	NA	NA	NA	Kidney	1E+00	NA	NA	1E+00
			Trichloroethene	2E-04	3E-05	3E-04	5E-04	Heart/ Immune System/ Developmental/Kidney/Liver	2E+01	3E+00	6E+01	8E+01
			Vinyl Chloride	9E-04	5E-05	3E-03	4E-03	Liver	3E-01	2E-02	1E-01	5E-01
			Semi-volatile Organic Compounds									
			1,4-Dioxane	3E-05	1E-07	NA	3E-05	Liver/Kidney/CNS/Respiratory System	4E-02	1E-04	NA	4E-02
			Benzo(a)anthracene	1E-06	1E-05	NA	1E-05	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	4E-06	1E-04	NA	1E-04	NA	NA	NA	NA	NA
			Bis(2-Ethylhexyl)Phthalate	1E-06	2E-06	NA	3E-06	Liver	2E-02	2E-02	NA	4E-02
			Inorganics									
			Chromium	2E-04	1E-04	NA	4E-04	Lung	6E-01	3E-01	NA	9E-01
			Cobalt	NA	NA	NA	NA	Thyroid/Respiratory System/ Lung	2E+00	5E-03	NA	2E+00
			Iron	NA	NA	NA	NA	GI Tract	2E+00	8E-03	NA	2E+00
			Manganese	NA	NA	NA	NA	CNS	1E+00	8E-03	NA	1E+00
			Nickel	NA	NA	NA	NA	Body and Organ Weight/Respiratory System	7E-02	2E-03	NA	7E-02
			Chemical Total	1E-03	3E-04	3E-03	5E-03	Chemical Total	3E+01	4E+00	6E+01	9E+01
		Exposure Point Total					5E-03					9E+01
	Exposure Medium Total						5E-03					9E+01
Medium Total							5E-03					9E+01
Receptor Total							5E-03					9E+01
							Total Excess Cancer Risk Across All Media	5E-03				Total Hazard Index (HI) Across All Media	89

[1] Noncancer hazards presented for the child receptor (birth to <6 years); cancer risks presented for the lifetime receptor.

Body and Organ Weight HI Across All Media =	0.07
CNS HI Across All Media =	1
Development HI Across All Media =	79
GI Tract HI Across All Media =	2
Heart HI Across All Media =	79
Immune system HI Across All Media =	79
Kidney HI Across All Media =	81
Liver HI Across All Media =	81
Lung HI Across All Media =	4
Respiratory System HI Across All Media =	2
Thyroid HI Across All Media =	3

NA = not applicable CNS = central nervous system GI = gastrointestinal

Note:
Only chemicals above EPA's threshold values are listed in this table

TABLE H-10.2
RISK ASSESSMENT SUMMARY
REASONABLE MAXIMUM EXPOSURE
Mansfield Trail Dump Site, OU1
Byram Township, New Jersey

Scenario Timeframe:	Future
Receptor Population:	Resident
Receptor Age:	Adult/Lifetime[1]

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Adult Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
			1,1,2,2-Tetrachloroethane	6E-07	8E-08	4E-06	5E-06	Liver	4E-04	5E-05	NA	4E-04
			1,1-Dichloroethane	2E-06	2E-07	1E-05	2E-05	Kidney	4E-03	3E-04	NA	4E-03
			1,2-Dichloroethane	3E-07	2E-08	2E-06	3E-06	Liver/Kidney	1E-03	7E-05	4E-02	4E-02
			1,4-Dichlorobenzene	7E-07	5E-07	3E-05	3E-05	Liver	4E-03	3E-03	1E-02	2E-02
			Benzene	6E-07	9E-08	2E-06	3E-06	Blood	6E-03	9E-04	2E-02	3E-02
			Bromodichloromethane	4E-07	3E-08	5E-06	6E-06	Liver	7E-04	6E-05	NA	8E-04
			Chloroform	1E-06	1E-07	2E-05	3E-05	Liver/Alimentary System/ Kidney/Developmenta	1E-02	9E-04	1E-02	2E-02
			Trichloroethene	2E-04	3E-05	3E-04	5E-04	Heart/ Immune System/ Developmental/Kidney/Liver	1E+01	2E+00	8E+01	9E+01
			Vinyl Chloride	9E-04	5E-05	3E-03	4E-03	Liver	2E-01	1E-02	2E-01	4E-01
			1,4-Dioxane	3E-05	1E-07	NA	3E-05	Liver/Kidney/CNS/Respiratory System	2E-02	8E-05	NA	2E-02
			Benzo(a)anthracene	1E-06	1E-05	NA	1E-05	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	4E-06	1E-04	NA	1E-04	NA	NA	NA	NA	NA
			Bis(2-Ethylhexyl)Phthalate	1E-06	2E-06	NA	3E-06	Liver	9E-03	1E-02	NA	2E-02
			Chromium	2E-04	1E-04	NA	4E-04	Lung	4E-01	2E-01	NA	6E-01
			Cobalt	NA	NA	NA	NA	Thyroid/Respiratory System/ Lung	1E+00	3E-03	NA	1E+00
			Nickel	NA	NA	NA	NA	Body and Organ Weight/Respiratory System	4E-02	1E-03	NA	4E-02
			Chemical Total	1E-03	3E-04	3E-03	5E-03	Chemical Total	2E+01	2E+00	8E+01	1E+02
		Exposure Point Total					5E-03					1E+02
	Exposure Medium Total						5E-03					1E+02
Medium Total							5E-03					1E+02
Receptor Total							5E-03					1E+02

Total Excess Cancer Risk Across All Media	5E-03
Total Hazard Index (HI) Across All Media	100

[1] Noncancer hazards presented for the adult receptor; cancer risks presented for the lifetime receptor.

Body and Organ Weight HI Across All Media =	0.04
Development HI Across All Media =	93
Heart HI Across All Media =	93
Immune system HI Across All Media =	93
Kidney HI Across All Media =	94
Liver HI Across All Media =	94
Lung HI Across All Media =	2
Respiratory System HI Across All Media =	1
Thyroid HI Across All Media =	2

NA = not applicable CNS = central nervous system GI = gastrointestinal

Note:
Only chemicals above EPA's threshold values are listed in this table